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*WITH WHICH IS INCORPORATED*

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**THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN, THE NATIONAL IRONFOUNDING EMPLOYERS' FEDERATION, THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION.**

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BRITISH CAST IRON RESEARCH ASSOCIATION.

The Registered Office and Laboratories of the B.C.I.R.A. at:—
21-23, ST. PAUL'S SQUARE, BIRMINGHAM.
*Telephone: Central 1985. Telegrams: CIRA.*
The B.C.I.R.A. Scottish Laboratories are:—
Foundry Technical Institute, Meek's Road, Falkirk (*Telephone 332*).

## Forthcoming Events.

SEPTEMBER 12-15.
*Iron and Steel Institute*:—Autumn meeting at Sheffield.

## Metals in the Service of Man.

The British Science Guild recently had an excellent idea of establishing an annual research and development lecture, with the object of bringing before the public at large, in a readily understandable form, some of the results of scientific research and its application to industry. The first such lecture was given recently in London by Prof. Sir Harold Carpenter under the title "Metals in the Service of Human Life and Industry." It proves to be an admirable *résumé*, mainly from the historical point of view, of the development of metallurgy. Sir Harold Carpenter argues that metals are entitled to be regarded as having contributed more to the comfort of the human race than has any other product of the physical universe. He also claims that through the practice of the art of metallurgy man developed those attributes which are the foundation of science and modern thought.

The early part of the lecture deals with the earth's crust and its composition, and the form and the extent to which metals are available through their ores. The historical development of the production and use of the metals is dealt with, particularly iron, and in an historical table cast iron is placed as subsequent to A.D. 1000, although direct iron is placed at between 2000 and 1,000 B.C., two thousand years after the previous major metallurgical discovery, that of brass. It is said that the Egyptians, about 1200 B.C. were acquainted with carburising, and at about 900 B.C. with quenching.

The blast furnace is claimed to be the most important instrument of production devised by man, and the rising curve of iron and steel production since 1800 in the case of pig-iron, and since 1860 in the case of steel, suggests that the increase in output may be enormous during the next few generations. More metal has, in fact, been used during the last thirty years than in all previous time. We cannot follow Sir Harold through his discourse on the properties, mechanical, chemical and physical, of the metals, and of the effects of science and metallurgy on the art of metal working, but altogether the lecture makes an admirable beginning for the new series.

## Carburising Cast Iron.

With the advent of newer processes for the manufacture of cast iron, the situation has arisen whereby an adequate carburising medium is required. In steel manufacture, recourse is had to pig-iron, usually either Swedish white or American washed, and no difficulties arise in meeting any particular specification. If, however, it is desired to recarburise what is virtually a high carbon tool steel into cast iron, the carbon in pig-iron is relatively so small that the yield per unit quantity is so insignificant as to be ruled out as a carburising medium. Of commercially-available material, there is a choice of coke, anthracite, retort carbon and sometimes electrode stumps. According to a German research petroleum coke, which is much the same thing as retort carbon, proved to be the most effective. Often additions to liquid metal are the most effective when introduced as a ferro-alloy, but in the case of carbon the production of a 6.6 per cent. ferrous alloy would be too expensive, and even then it is by no means certain that the carbon would be in a form for easy assimilation by the bath. Charcoal which used to be extensively used in crucible steel manufacture has, according to unpublished information reaching us, not proved to be very successful. Unquestionably, the state of division of the carburising medium is of paramount importance, and large pieces of carbon in any form should be rigorously excluded. Once a slag is formed upon a bath of molten cast iron, intense puddling has to be resorted to, as otherwise the carbon addition merely floats upon the surface. A final reflection upon this subject, is that after years of cupola control designed to yield carbon as low as ever possible, it now seems strange that conditions have arisen demanding the creation of a technique for increasing the carbon content of cast iron from what is virtually the "tool steel" range to the low-carbon cast-iron series. It would be helpful to those concerns which have installed some of the melting processes competitive with cupolas, if any data of experiments made were rendered available for the foundry industry.

C

## Correspondence.

*[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]*

### Me Fecit 1569.

*To the Editor of* The Foundry Trade Journal.

Sir,—I have read with interest your correspondents' replies to my inquiry relating to the above, and must particularly thank Mr. Wesley Lambert for his most illuminating letter.

Mr. Lambert is perfectly correct in his assumption that the name Hemony is cast in capitals about the skirt of the bell. The letter E is almost illegible, and for that reason I used a dash to indicate the unknown letter in my original communication.

I do not know, Mr. Editor, whether any of your correspondents would care to see the bell in question, but I would be very pleased to leave the specimen in your care for inspection.—Yours, etc.,

Glynne Williams.

Lyme Regis,
September 1, 1933.

### The Steel Castings Association.

*To the Editor of* The Foundry Trade Journal.

Sir,—I have just noticed the reproduction in your issue of August 31 of a letter sent to "The Times" on August 18 by Mr. W. B. Lake. Mr. Lake's remarks are interesting, but not convincing. So far as the Steel Castings Association is concerned, much valuable work has already been done, and our Committee must be complimented on the results achieved. It is unfortunate that they were temporarily repulsed by what Mr. Lake very correctly describes as an "insignificant minority." In my opinion, this was due to bad generalship, and nothing else. Other industries have had to face equally difficult problems, but have found ways and means of demonstrating to these "objectors" that, even in their own interests, the best policy would be to give loyal support to their Association.

Within our own ranks I am convinced that we have the brains and the power to decide that "those who are not with us are against us," and to formulate a plan of defence and offence in the interests of the whole trade.

With regard to the main body—The Iron and Steel Corporation of Great Britain—the men now in control of this are fully acquainted with the work in a practical sense. They know all the difficulties and what is really needed to put the whole trade in a healthy condition, and if they don't, who does?

Government interference is not desired. Government support and assistance is quite a different thing and will be appreciated.—Yours, etc.,

T. McLean,
Managing Director.

Parker Foundry (1929), Limited,
"Tropenas" Steel Works, Derby.
September 12, 1933.

**Electrical Industrial Furnaces.**—At the recent exhibition of electrical industrial furnaces held in Germany, the latest types of electric furnace were on view. Siemens & Halske showed a 4-ton high-frequency furnace equipped with a motor-generator set. No mechanical rectifier is now used with these furnaces, but a grid-controlled mercury-vapour rectifier. Arc furnaces were also exhibited, particularly of the type employed for the manufacture of ferro-manganese and as incorporated in the extensive plant erected by Siemens at Sestaphoni in the Caucasus. The present capacity of these furnaces is 40,000 to 45,000 tons of ferro-manganese per annum, but the plant can be readily extended to a capacity of 150,000 tons. These furnaces incorporate various improvements, as in regard to the adjustment and maintenance of the electrodes.

## District Presidents.—No. 5.

### INSTITUTE OF BRITISH FOUNDRYMEN, EAST MIDLANDS BRANCH.

Mr. Philip A. Russell, President of the East Midlands Branch of the Institute of British Foundrymen, received his early training as an apprentice in his father's firm—S. Russell & Sons, iron and brass founders and engineers, of Leicester. His apprenticeship was interrupted by the war, in which he served as an Observer Sub-Lieutenant in the Royal Naval Air Service. On demobilisation he took a course of metallurgy under Prof. Turner at Birmingham University, obtaining his B.Sc. degree with honours.

Mr. Philip A. Russell.

He then rejoined his father's firm and is now assistant manager to his brother, Mr. S. H. Russell (Past-President of the Institute), and is particularly occupied with the machine moulding factory and the metallurgical and alloy cast iron side of the business.

He joined the Institute in 1924 and was elected to the General Council in 1931. He also took a very active part in the organisation of the Leicester Conference in 1928, and has read Papers before several branches of the Institute. He has been convener of the Cast Iron Sub-Committee of the Institute's Technical Committee since its inception in 1930.

**Corrosion Recorder.**—In "Metallwirtschaft," V. V. Skorchelletti and A. J. Shultin describe an instrument which has been termed a "Corrosiograph," for the purpose of recording the change in weight of a test sample as a result of corrosion.

## The Spelter Position.

*(Concluded from next column.)*

there has been an improvement from the extruded rod and section manufacturers, due partially, no doubt, to a certain scarcity of brass scrap. Trade with India, too, has been quiet, although a steady demand for hard spelter exists, and yellow metal has recently shown signs of picking up after a prolonged quiet spell. For the moment there certainly does not seem to be much rise in spelter, but after the spell of heavy liquidation we have seen a further marked reaction is unlikely.

## The Spelter Position.

By "Onlooker."

The spelter market has recently somewhat disappointed its supporters by giving way rather sharply. From a high point of £19 there has been a decline to about £16 15s., without consumers flocking in any great numbers to make purchases. Some recovery has since been made. The main trouble appears to be that those trades using spelter are far from busy, and in consequence undue pressure has been put upon the London Metal Exchange to absorb hedging sales made by producers against incoming shipments. The final stages of the advance in spelter values when the American inflation fever was at its height were somewhat overdone, and in consequence the reaction that followed was perfectly normal, leaving the market all the healthier for the shake out, but the secondary downward movement which has occurred is somewhat disconcerting.

In America the situation has improved quite considerably, and consumption is now running at something like three times the rate it was in the early part of this year when the statistical position in the States was so bad. Since then stocks have come down across the Atlantic, but the optimism so engendered has been a little overdone, and in consequence production has latterly evinced an inclination to exceed consumption, but there is no reason to suppose that the situation will be allowed to get out of hand, and it seems pretty certain that stocks in the United States will not be allowed to accumulate unduly. Cartel stocks, too, have been able to record a reduction this year, and when the increase in output from 45 to 50 per cent. was made it was stated that no addition to the reserves was anticipated, but since then consumption seems rather to have declined, and the market is undoubtedly a little uneasy about this additional 5 per cent. There is also a certain lack of unanimity, or at least it appears so to a good many people, in the ranks of the cartel members themselves as to the continuance of this body, but possibly the recent setback in the quotation will have the effect of closing the ranks and promoting unity.

### Effect of Duty.

The effect of the application of a 10 per cent. duty on foreign spelter has, of course, been far reaching, but it has not entirely shut out brands not originating in the Empire, for since the quotation climbed within measurable distance of £20 some foreign producers have elected to face the duty and put metal into this country. Nevertheless it is obvious that Canada and Australia have a stranglehold on our home market, although the protective tariff has also assisted British production, which during last year (a period in which the world total was well below normal) increased to close on 80,000 tons, or nearly four times as much as in 1931. In fact, after the United States, Belgium and Poland, Great Britain was bracketed fourth in importance with Canada. Whether as a result of protection users here are being compelled to pay more for their spelter is a moot point. Some criticism has been levelled at the producers of high grade zinc for their maintenance of a £2 10s. premium over G.O.B. brands, but since sales are being made to consumers on the Continent on the same basis, the imputation of victimisation appears to be groundless. Nevertheless, with spelter at £17, an extra charge of 50s. for electrolytic seems unduly high, and this question deserves close attention by the producers concerned.

As to the position of those trades using spelter, reference to statistics shows that the shrinkage has been most marked in the galvanising industry, and that sheet zinc has kept up fairly well. Demand by the brass makers has also shown a decline, but latterly

*(Concluded in previous column.)*

# The Shipping, Engineering and Machinery Exhibition.

In our last issue we gave a brief survey of the Shipping, Engineering and Machinery Exhibition, which is now being held at Olympia until September 23. This week we give a detailed description of those exhibits which are of outstanding interest to foundrymen. The Institute of British Foundrymen and the Foundry Trades Equipment and Supplies Association, Limited, pay their official visit to the Exhibition on Monday, September 18, and the British Cast Iron Research Association and the Iron and Steel Institute on Wednesday, September 20.

**Sir W. G. Armstrong, Whitworth & Company (Engineers), Limited,** Scotswood Works, Newcastle-upon-Tyne.—A notable exhibit at this stand is a complete range of pneumatic tools of the latest design, including rotary air tools, concrete breakers, rock drills, coal picks,

A VIEW OF THE STAND OF MESSRS. BRITISH PIGIRONS, LIMITED, AT OLYMPIA.

"Plus" type riveting and chipping hammers, etc. All tools are demonstrated on the stand in a specially-constructed sound-proof compartment provided with ample window space. Compressed air is supplied by one of the latest Armstrong-Whitworth portable compressors.

A wide range of refined irons in the forms of "pig," fractures, sectioned castings, etc., is exhibited by the Ironfounders' Company, Close Works, Gateshead-upon-Tyne. By the use of these "New Process" refined irons it is possible to obtain perfect homogeneous and tough iron castings of very high tensile strength which compare most favourably with castings hitherto made of steel. They are proving particularly valuable in the manufacture of castings for the automobile industry and for hydraulic steam and oil engines.

**B.E.N. Patents, Limited,** Gorst Road, Chase Estate, London, N.W.10.—The exhibits on this stand include a selection from the B.E.N. complete range of portable and fixed spray-paint plant and equipment, which covers all requirements from a small outfit which can be carried by hand to large multi-gun spray sets. One of the features on this stand is a glass-fronted spray booth where spray-paint demonstrations are being carried out during the Exhibition. The spraying machines exhibited include: (1) Portable "Pneu-Sprays" equipped with electric motor and petrol-engine drive. (2) A "Pneu-Matic 12" portable two-gun spray-paint plant designed for multi-gun spray work. This machine is mounted on heavy-duty wire wheels fitted with Dunlop tyres, the weight being evenly distributed so that the unit can be moved over uneven ground with extreme ease. (3) Spray-paint combination outfits made up of the essential units (with the exception of the air-compressing equipment) necessary for high-grade spray finishing work, and comprising a B.E.N. spray gun, an oil and water separator with air-reducing valve, and high- and low-pressure gauges, etc.

**Black & Decker, Limited,** Slough.—At this stand there are exhibited portable electric tools and electric grinders. The range of these is as follows:—Portable electric drills from ¼-in. capacity to 1½-in. in steel, with bench and post drill stands. Portable electric screwdrivers and nut runners for driving screws into wood or metal, and for running on nuts and set screws in assembly plants. Portable electric sanders for sanding castings, etc., and for cleaning of welding seams. They are also used for sanding and polishing boat hulls, car bodies, etc., previous to varnishing and enamelling. Portable electric grinders for fettling castings and forgings. Portable electric buffers. Valve refacers, for refacing heavy oil and marine petrol- and gas-engine valves up to 2-in. stems.

As distributors for Van Dorn electric tools, the firm is exhibiting Black & Decker-Van Dorn high-cycle tools and heavy-duty grinders and buffers.

**Bradley & Foster, Limited,** Darlaston, Staffs.—A comprehensive range of samples of refined pig-iron, divided into four main groups—blended all-mine pig-iron, degasified cylinder pig-iron, refined alloy pig-iron, refined malleable pig-iron—is shown on this stand.

The blended all-mine quality is produced by a careful selection of materials on a basis of mechanical strength properties. By special methods it is possible to make this iron with known and regular physical and mechanical strength to match any required tests.

The degasified cylinder iron is produced by Bradley's patent process of stirring and agitating the molten metal while in the receiver, in order to ensure a completely homogeneous mixture free from gases and slag particles. Sound castings of high strength are obtained with the use of this iron.

The alloy irons include a wide range of qualities from the low nickel-chrome irons for direct use up to various types of austenitic ingots. Several of these are on view for the first time. A special feature is the exhibition of castings made in these alloy cast irons.

A complete range of fractures of refined malleable pig-iron is on view and serves to demonstrate the elaborate system of grading employed at these works.

**The British Cast Iron Research Association,** 21-23, St. Paul's Square, Birmingham.—The Association's exhibit forms part of the stand of the Department of Scientific and Industrial Research, which is designed to illustrate the research work which is being carried out in the Department's own establishments and in the laboratories of co-operative research associations formed under the auspices of the Department.

The B.C.I.R.A.'s exhibit is divided into eight parts:—

(1) *Balanced-Blast Cupola.*—It has been frequently shown that it is important in cupola melting to attain high temperatures with relative freedom from oxidation of the metal. Improvements in the cupola have been made by the Association and the balanced-blast cupola has many advantages over the ordinary system. Hot metal relatively free from oxidation is produced, with a consequent reduction in the amount of scrap and defective castings. A considerable reduction in the amount of coke used is effected, and this saving varies between 20 and 40 per cent. British and foreign patents are held by the Association for the design of the cupola, which is available to members.

(2) *Heat-Resisting Cast Iron.*—The Association is responsible for the development of two cast irons which have particularly good heat-resisting properties. Silal is an easily machinable grey cast iron which is used up to temperatures of about 850 deg. C. Nicrosilal is a much stronger alloy cast iron which can be used up to temperatures of about 1,000 deg. C. The exhibit shows descriptions of these two cast irons, with photomicrographs and a list of properties; a diagram of the effect of silicon on the growth of cast iron; a photomicrograph of furnace castings in Silal and grey iron after use; a photomicrograph of a locomotive firebar in Silal before and after use; and Silal and Nicrosilal castings shown by the courtesy of a number of the licensees.

(3) *High-Strength Cast Iron.*—The demands of the engineering industries have resulted in the production of cast iron with greatly improved mechanical strength. Various methods have been used to achieve this increased strength, notable among which are the use of alloys, inoculation of the melt and centrifugal casting.

This exhibit shows cast iron containing such elements as nickel, chromium, copper, molybdenum, etc., with the physical properties; centrifully-cast material; and test-bars of inoculated cast iron, with illustrative photomicrographs.

(4) *Corrosion-resisting Cast Iron.*—This section shows the corrosion of high-silicon cast iron, Ni-resist, Nicrosilal, high-phosphorus grey iron and hematite cast iron in normal mineral acids, with a few castings which are used where corrosion-resistant alloys are necessary.

(5) *Publications.*—Illustrations of publications of the Association, including research reports and bureau reports.

(6) *Malleable Cast Iron.*—Cases showing structures and test results of white-heart and black-heart malleable cast iron, with castings made by the two processes.

(7) Various finishes which are used on cast iron, including enamelling and plating.

(8) *Moulding Sands, Core Sands, Core Oils and Cupola Refractories.*—The testing of moulding sands has received a great deal of attention during the last ten years and testing equipments which have been designed to give the utmost data on sand for foundry use are shown here. Subject matter on core sands, core oils and cupola refractories is also shown.

**The British Oxygen Company, Limited,** Angel Road, Edmonton, N.18.—This stand, which is much larger than in previous years, is devoted to showing the company's range of plant and equipment for use, or in connection with, applications of oxygen, acetylene and other industrial gases, and of electric-arc welding and equipment.

Oxy-acetylene equipment for the welding, hand-cutting and surface-heating of metals, including equipment using other fuel gases, is represented by familiar types of B.O.C. blowpipes, regulators and cutters. In addition, there are several new items of equipment that include the B.O.C. "Economy" vacuum-type acetylene regulator; two-jet welding blowpipes; a cutter for removing defects from semi-finished steel, and a specially light type of hand cutter.

There is a display of the various gas-welding rods, fluxes and other welding materials manufactured or marketed by the company.

As an indication of the heavy engineering side of the company's business, types of high-pressure gas and air water-lubricated compressors are exhibited, as well as oxygen cutting machines for all classes of steel cutting. A display of gears hardened by the "Shorter" process furnishes an indication of its applications.

A unique development of the oxy-acetylene process which is being demonstrated is the coating of metal by the metal-spraying pistol, the sole selling rights of which are now held by the British Oxygen Company, Limited. Any metal or alloy capable of being drawn into wire, and of being melted in any oxy-coal gas, oxy-hydrogen, or oxy-acetylene flame, can be deposited by means of the pistol on metal, wood, fabric or any other surface. Thus in a works where various different coatings are required, the process avoids the high cost of laying down separate vats for the electro-deposition of such metals as nickel, copper, cadmium and zinc. The thickness of the metal deposited is only limited by the necessities of each individual case. Although normally much thinner coatings are applied—and 0.004 in. is a sufficient zinc coating to safeguard steel and cast iron from atmospheric oxidation—tin coatings of $\frac{1}{8}$ in. have been successfully deposited on the surfaces of certain large tanks.

The pistol is small and easily manipulated in one hand. It weighs only $3\frac{1}{2}$ lbs. and is capable of affixation to any moving or stationary jig for automatic or semi-automatic manipulation on mass-production work. Examples of this use of the pistol are the spraying of the exterior walls of cylindrical parts, such as cast-iron rolls, rotated in a lathe, and of the interior walls of tubes. As no vats are required for the immersion of articles under treatment, the sizes of such parts are unlimited.

Metal spraying provides protection, in one way or another, from most corrosion-producing atmospheres: zinc spraying for atmospheric corrosion; aluminium for sulphurous corrosion; nickel, lead, etc., for corrosion from other chemically-impregnated atmospheres. The preliminary cleaning process is sandblasting, so that no "spotting out" of acids or flux, or other deterioration of the coating due to attack from beneath can occur.

One of the most important features of the process is the fact that the pistol will deposit aluminium. Aluminising is a patented process for the protection of metals from scaling, due to exposure to high temperatures. It consists of spraying an aluminium coating on to the article to be treated, and, by means of a suitable heat-treatment, alloying the aluminium with the base metal. During the process of aluminising steel, a compound coating is formed, which is composed of three layers:—(1) Next to and fused into the steel is a solid solution alloy of iron and aluminium; (2) a layer of iron-aluminium alloy ($FeAl_3$), together with a slight excess of free aluminium; (3) a thin coating of aluminium oxide (alumina).

As long as the aluminium-rich coating remains on the surface of the steel, scaling is impossible, and it is only when aluminised steel is heated above 1,000 deg. C. that an accelerated rate of penetration of the aluminium into the steel reduces the percentage of aluminium in the coating sufficiently to cause oxidation to commence. Aluminising can therefore be used with advantage at all temperatures up to 1,000 deg. C.

The compound coating produced is strongly adherent, being alloyed to the base metal, and is impervious to gases, so that while being itself unaffected by hot oxidising gases, it also completely excludes them from contact with the iron. The iron is therefore unable to take up oxygen, and scaling is prevented. The nature of the coating is such that even if abrasion occurs which is sufficient to remove the outer skin of alumina, a fresh layer is immediately formed by the oxidation of the exposed aluminium-alloy under-layer. Articles of almost any size can be protected against heat oxidation by aluminising.

**British Pigirons, Limited,** Abbey House, 2, Victoria Street, London, S.W.1.—The floodlit stand of British Pigirons displayed representative fractures of "Midhill" and "Glenhill" Allmine special pig-irons, with test-pieces, microphotographs, etc. These brands are smelted at the company's associated works in Scunthorpe, Lincs; the examples shown are guaranteed blast-furnace products and are not refined or subjected to any secondary heat-treatment.

There are as wide a range of representative castings as the stand is capable of holding, varying from a 3-ton casting for the chemical trade down to the most minute example in grey iron. Special mention should be made of a series of chilled test-pieces carried out by one of the largest chilled-roll makers in this country.

The technical department exhibits a comprehensive range of microphotographs up to a magnification of 2,000, and complete pig-iron mixtures are recommended for all types of castings.

**Broom & Wade, Limited,** Engineers, High Wycombe, Bucks.—A full range of "Broomwade" pneumatic tools suitable for all shipping, aero, automobile and general engineering and contracting duties are shown, all of which are available for working demonstration. Several examples of "Broomwade" compressors are also shown on the stand, including the following types:—

No. 22 two-cylinder 7 in. × 8 in. air compressor, actual delivery 130 cub. ft. of free air per minute at 100 lbs. working pressure.

Patent motor-driven sleeve valve compressor, working. Piston displacement 116 cub. ft.; 100 cub. ft. free air actually delivered per minute at working pressures up to 100 lbs. per sq. in.

Rotary air compressor, type R.60.

No. 120 single-cylinder 5 in. × 6 in. air compressor, actual delivery 25 cub. ft. of free air per minute at 100 lbs. working pressure.

No. 8 single-cylinder 3 in. × $2\frac{1}{4}$ in. air compressor, actual delivery 3.5 cub. ft. free air per minute at 100 lbs. working pressure.

No. 10 single-cylinder 3 in. × $3\frac{3}{4}$ in. air compressor, actual working 8 cub. ft. of air per minute at 100 lbs. working pressure.

Type 3 pneumatic trench pump.

**Electric Resistance Furnace Company, Limited,** 17, Victoria Street, London, S.W.1.—A series of recently-developed self-regulating normal frequency induction furnaces for heat treatment, manufactured under Campbell and Ugine-Infra patents, constitutes the principal feature of this exhibit. These furnaces are regulated without the use of automatic temperature control gear. A physical constant, namely the magnetic change point of various alloys, provides an infallible means of accurate control. Bars of a suitable alloy are inserted into the furnace and lose their magnetism at the required temperature, causing a diminution in the rating of the furnace. The temperature then falls until the bars regain their magnetism, and the rating is automatically increased. Simple means are provided for changing the bars and so varying the working temperature of the furnace according to requirements.

There are shown a 7-kw. muffle furnace suitable for temperatures up to 1,000 deg. C.; a 5-kw. low-temperature melting furnace for lead, aluminium and low-temperature alloys; a balancing furnace for the heat-treatment of small tools, in which the magnetic properties of the tool steel itself are employed to control the correct moment of quenching; a continuous hardening furnace for small parts, such as chain links, taps and dies, in which not only the temperature control, but also the propulsion of the work through the furnace, are effected magnetically. In this remarkable furnace there are no moving furnace parts to propel the work through the furnace. In addition, a small forced air circulation furnace is shown, employing the Gill screw type fan.

**Elliott Bros. (London), Limited,** Century Works, Lewisham, London, S.E.13.—A comprehensive display of electrical and mechanical measuring, testing, indicating and recording apparatus is shown, together with heat economy and control apparatus. The latter includes automatic boiler control, flue gas analysis, smoke density, humidity and temperature equipment, incorporating automatic regulators for controlling temperatures of furnaces, etc., programme transmitters, resistant thermometers and thermo-electric pyrometers, optical and radiation pyrometers, illuminated circuit diagrams, bin level indicators for use with pulverised fuel and other powdered substances, etc.

**Flextol Engineering Company, Limited,** 18, Dartmouth Street, Westminster, S.W.1.—This exhibit includes a full range of "Flextol" power-driven hand tools and accessories with recent improvements and modifications in design. Rotary handpieces (both straight and right-angle drive) at all speeds are available for such operations as grinding with rotary or cup wheel or flexible abrasive disc, buffing, polishing, wire brushing, milling, cutting, sawing, sanding, etc.

New additions to "Flextol" equipment include flexible shaft equipment with infinitely variable gear, and a machining head for headers of "Babcock" boilers.

**Foster Instrument Company,** Letchworth, Herts.—This exhibit consists of a complete range of electrical temperature measuring instruments for industrial and laboratory use, and comprises thermo-couple, optical and fixed-focus radiation pyrometers, together with electrical "distance" thermometers. Both indicating and recording instruments are shown, including multi-point strip recorders capable of producing permanent records of any number of temperatures up to six on one chart, each record being in a different and clearly distinguishable colour.

Thermo-couple pyrometers of both rare and base metal types are shown, the latter types including examples of this firm's patented concentric or "tube" type thermo-couple.

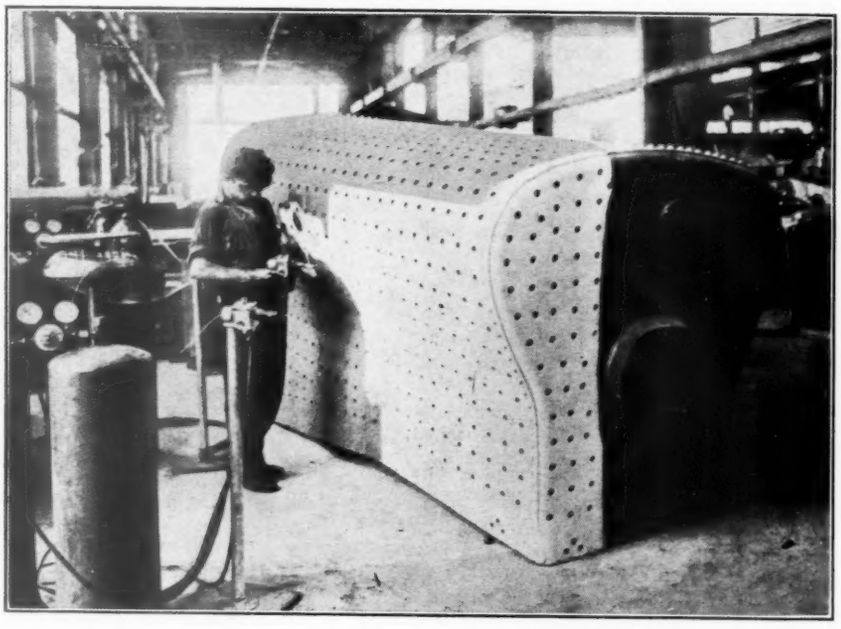
Optical pyrometers suitable for measuring temperatures above 700 deg. C. and of the "lampbridge" unit type are exhibited, in addition to automatic temperature controlling pyrometers for use in conjunction with oil, gas, and electrically-heated apparatus.

**Foundry Equipment, Limited,** 15, Victoria Street, London, S.W.1.—The "Felco" all-steel

triple-gear chain blocks which are shown on this stand are claimed to show a marked advance and improvement over any other types of chain blocks which have hitherto been placed on the market. They are made entirely in high-quality steel and do not contain a single casting, consequently they are very strong and robust, yet light and compact.

Their chief features are:—Great strength and security owing to all solid steel construction; light in weight and compact; short headroom; self-sustaining; unbreakable handwheel—heavy gauge steel stamping; machine cut gears—case hardened; load wheel—solid steel; speedy and high efficiency; entirely British manufacture; all tested to 50 per cent. overload.

In addition, the "Ropelock" rope pulley hoist can be seen, of which a notable feature is the short headroom. It elevates, lowers locks and unlocks with one rope only, and so allows the operator to have both hands free for the control of the load.



THE METAL-SPRAYING PISTOL, WHICH WAS A FEATURE OF THE BRITISH CXYGEN COMPANY'S STAND, IS HERE BEING USED FOR COATING THE FIREBOX OF A LOCOMOTIVE WITH ALUMINIUM.

**F. Gilman (B.S.T.), Limited,** 221, High Street, Smethwick.—A full range of flexible drive machines and working heads for various processes are exhibited. The machines are divided into two classes: "Skatoskalo" and "Multi-flex" machines.

The range of "Skatoskalo" machines includes machines for tube scaling from ½ in. i/d. to 4 in. i/d., condenser, evaporator, boiler and economiser tubes. There are also equipments for surface scaling of Lancashire boilers, drums, rats and for ship scaling.

The "Multi-flex" range of machines includes single-, two-, four- and eight-speed machines for floor and bench mounting, as well as for suspension, and comprises equipments for every class of grinding, drilling, sanding, tyre rasping, cellulose rubbing and polishing, filing, milling, die grinding and other purposes.

The firm is also showing a full range of their flexible shafts which they manufacture from 4 mm. up to 35 mm. dia.

**The Incandescent Heat Company, Limited,** Cornwall Road, Smethwick, Birmingham.—This well-known firm is showing three typical standard furnaces, heated by town's gas, oil fuel and electricity. Each of the exhibits is working, and have the same internal dimensions, viz., 24 in. by 18 in. by 12 in. This permits visitors to investigate the working conditions of each unit, the atmosphere control and the evenness of temperature, and from the meters attached to the plant to obtain a sound basis of operating cost, since the records of fuel consumptions of each furnace are open for inspection.

The gas-fired furnace incorporates the **Patent** Incandescent system of firing, and is constructed on the "Super" design. It is fired below the hearth by a series of burners on each side, so that the load under treatment, in addition to being heated by radiation and convection, is also heated by conduction through the bottom. The waste gases from the furnace are withdrawn from the working chamber through ports located near to the door opening, maintaining at this point an effective waste-gas screen, enabling heat-treatment to be carried out with the minimum scaling during the heating cycle. Extensive recuperation is provided to the furnace, and a similar unit, tested by an independent gas company, operated under normal working conditions at an efficiency of over 60 per cent.

The oil-fired furnace is also under-fired so that there is a live heat delivery to the load under treatment through the hearth. The burner is of a special type, being the only combination-type burner on the market. The burner, its register and burner block form a complete oil-burning unit and can be supplied separately as such. The burner itself incorporates flame adjuster, automatic jet-cleaning device, self-cleaning strainer, oil- and air-control valves.

The electric furnace is of the resister type, and is also arranged with a live bottom. The advantage of this unit is that it is completely portable, the whole of the contactor gear being carried in the back of the furnace. A movable sill is provided on this unit so that an effective refractory seating is obtained for the door.

Each of the furnaces exhibited is capable of operating easily at 1,000 deg. C.

The exhibit also includes samples of carburising pots, etc., manufactured by the firm's "Strongweld" process, pyrometer-indicating equipment, and temperature-control apparatus.

**The International Meehanite Metal Company, Limited,** 14-20, Church Street, London, N.1.—On this stand are shown samples of grey-iron castings, the metal of which has been treated by "Meehanite" methods, ensuring exceptional strength and toughness. In "Meehanite Metal," it will be remembered, the crystalline grains are closely knitted together and of rather small size. In this metal the free carbon exists mostly in the form of small nodules surrounded by a matrix of ferrite and pearlite, and when occurring in flake form these are curved and differ in size, shape and abundance from those existing in grey iron. "Meehanite Metal" is consistently produced, in which the tensile strength is 57,000 lbs. per sq. in., running frequently to 70,000 lbs. The tensile strength in the various products, however, may be varied at will from 45,000 to 60,000 lbs. per sq. in. An elongation as high as 2 per cent. is not an infrequent occurrence, and under transverse test the metal will stand before fracture a central load varying from 5,500 to 8,000 lbs., accompanied by a deflection that is rarely lower than 0.16 in. and frequently as high as 0.20 in.

In machining, this material behaves more like steel than grey iron, planing off with a half curl in place of a chip, and at the lathe bringing off curls from two to three inches in length. A further feature in connection with "Meehanite Metal" when under the action of heat, is its retention of strength at high temperatures. The ordinary Brinell of "Meehanite Metal" is from 200 to 240, or from 240 to 280, depending upon the kind of material desired. This may be increased by heat treatment to as high as 650. These characteristics give the metal extreme resistance to abrasion.

The exhibits on the stand include stampings made from "Meehanite Metal" dies, which have been cast to size in the foundry and given a file-finish, giving a considerable saving over steel dies. There is a camshaft in "Meehanite Metal," and several examples of gears to show the excellent machinability.

**Lacy-Hulbert & Company, Limited,** Boreas Works, Beddington, Croydon.—This company's exhibits include portable petrol and electric-driven air compressors of a particularly ingenious design embodying patent air compressors type "L.V." fitted throughout with ball and roller bearings, water cooled by means of a hopper and small radiator. These sets have been particularly designed for operating spray painting equipment, and small pneumatic tools.

Air compressor and vacuum pumps of the company's well-known 2-cyl. opposed type, suitable for pressures up to 35 lbs. per sq. in., are shown, together with vertical high-speed air compressors. The latter are of the patent type fitted throughout with ball and roller bearings for direct coupling to electric motors or other prime movers, and capable of speeds of 1,200 to 1,500 r.p.m. These machines are built in eight sizes, the outputs being from 1 to 85 cub. ft. of free air per minute (F.A.D.) at pressures up to 200 lbs. per sq. in. Small vertical single-acting machines, water cooled and air cooled, fitted with ball bearings, are included on the stand.

**Major, Robinson & Company, Limited,** 385-7, City Road, Cornbrook, Manchester, 15.—There are on view several models of the "Scols" tube bending machines for bending gas, steam, hydraulic, copper and conduit tubes, from ¼-in. to 4-in. dia., without heating or loading. Other interesting specialities of the firm's manufacture being exhibited are the "Scols" graphite, asbestos and white pipe jointing compounds, suitable for all screwed and flanged joints; they are non-poisonous and do not contain any injurious or corrosive matter.

"Scols" iron and steel cements for iron and steel foundries, engineers, shipbuilders, dry dock and gas companies, "Scols" elastic cement for use on the seams of boilers, boiler patches and fractures, tanks, etc., and "Scols" aluminium filling for aluminium castings are also prominently exhibited on the stand.

**The Mond Nickel Company, Limited,** Thames House, Millbank, S.W.1.—The principal feature of the stand is a large circular rotating chart giving recommended compositions of nickel cast iron for various types of casting, together with the properties obtainable, while the exhibits will comprise examples of the important applications of nickel alloys in marine and general engineering.

The following are among those of chief interest:—A new "Radicon" reducing gear made by David Brown & Sons, in which the worm and worm wheel are respectively of nickel steel and nickel bronze. Nickel steel chisels, which give many times the life of those in ordinary carbon steel and which may be easily "dressed" with a file. Cylinder liners in nickel cast iron and corrosion-resisting castings in austenitic cast iron. Nickel-copper condenser tubes, which have contributed so largely towards the elimination of corrosion problems, castings in heat-resisting nickel-chromium alloys, internal combustion engine components in light aluminium alloys containing nickel.

**Murex Welding Processes, Limited,** Ferry Lane Works, Forest Road, Walthamstow, E.17.—This concern, which is an amalgamation of two pioneer companies in arc welding, Alloy Welding Processes, Limited, and the Premier Electric Welding Company, Limited, show a comprehensive range of welding plant, electrodes, and welding products. Included as an exhibit is a full-sized portion of a cargo ship's midship bilge section. Amongst the plant on show and for demonstration are a 600-amp. single-carcass type motor generator set specially designed for high-speed welding, a portable static transformer electric arc welding plant, and a detachable unit motor generator set for the welding of railway crossings, structures, etc. An automatic coal gas-cutting machine, lent by the courtesy of the British Oxygen Company, Limited, is also included.

Murex Welding Processes, Limited, owing to their patented method of manufacture, are able to produce electrodes suitable for all kinds of special steels and alloys, and demonstrations are given on their stand in the welding of these materials. Several new types of electrodes for arc welding are being demonstrated, and special interest is being taken in their electrode for high-speed welding. During recent years, the bend test has become increasingly popular in connection with the testing of weld metal, and a hand-bend testing machine is shown in operation.

**Philips Lamps, Limited (Industrial Section),** Philips House, 145, Charing Cross Road, London, W.C.2.—The headway made during the past few years in the application of X-rays to industrial test and inspection problems is well illustrated on this stand. A selection of radiographs makes it evident that X-rays, as a non-destructive method of testing, now play an important part in the determination and maintenance of quality. Particulars of "Metalix" Industrial X-ray equipment on view are:—

(1) "Metalix" Makro 55.—This apparatus is suitable for the examination of plate thicknesses $\frac{1}{8}$th of an inch of iron and up to 2 in. of aluminium. (2) "Metalix" Makro 100.—A small and compact outfit capable of penetrating up to $\frac{3}{4}$ in. of steel and 3 to 4 in. aluminium. (3) "Metalix" Makro 200.—This apparatus is mounted on a motor-car trailer and can be used for the examination of steel castings and welds up to 4 in. in thickness. (4) "Metalix" apparatus for measuring the thickness of ships' plates. (5) "Metalix" crystallographic apparatus.—This is a simple form of equipment for the production of X-ray diffraction pictures, specially designed round the requirements of metallurgists and works' chemists. In all of the apparatus is embodied the "Metalix" principle of protection against unwanted X-rays and accidental contact with live parts. Whilst in operation, all "Metalix" apparatus is perfectly innocuous. The simplified control system enables the equipment to be worked by an ordinary artisan. (6) Philips welding rectifier.

**Quiksol Products, Limited,** 46, Watling Street, London, E.C.4.—The foundry fluxes on view are intended for use during pouring. They protect the metal from oxidation and readily dissolve oxides formed. The welding fluxes meet the requirements of every welding and brazing operation, especially for aluminium bronzes and aluminium alloys.

**Reavell & Company, Limited,** Ranelagh Works, Ipswich.—This company is exhibiting a selection of two-stage charging compressors for Diesel engine auxiliary purposes—they are of two types up to pressures of 450 and 1,000 lbs. per sq. in. Two hand-driven charging compressors for similar duties, one a two-stage lever-driven machine, suitable for pressures up to 450 lbs. per sq. in. (L.C. type), and the other a vertical two-stage compressor suitable for pressures up to 1,000 lbs. per sq. in. (V.H.D. type) are shown. There are also two hand-driven compressors, one suitable for charging duties up to 200 lbs. per sq. in. and one suitable for starting gas and oil engines.

A selection from their range of standard single-stage vertical compressors, suitable for pressures up to 100 lbs. per sq. in., the smallest being a single-crank air-cooled machine, and the largest a three-crank compressor, suitable for delivered volumes up to 300 cub. ft. of free air per minute, are exhibited. They are also showing two of their range of vertical double-acting two-stage crosshead type compressors, provided with force lubrication throughout. These are suitable for general workshop use where pneumatic tools, etc., are used. Four different types of rotary compressors are also being shown.

**Sheepbridge Stokes Centrifugal Castings Company, Limited,** Sheepbridge Works, Chesterfield.—Typical examples are exhibited of castings in various alloy cast irons manufactured by their patented centrifugal process of casting and also by their special process of casting in sand. Samples of castings manufactured by the centrifugal process include piston ring pots, cylinder liners, sleeve valves, bushes and other cylindrical-shaped components. The exhibits under this heading are in the cast form and also as finished machined components. Fractures of sand castings illustrate grain structure and emphasise soundness.

The alloy cast irons exhibited show material designed to cover a wide range of special duties, such as resistance to wear (abrasion and erosion), heat (high and low temperatures), and corrosion (various), and include the following:—"Centrard."—Suitable for all parts to resist wear and corrosion. The whole or a limited portion can be hardened by the nitrogen hardening process to give a surface hardness of 1,000 Brinell. "Hypocrode."—A high chromium austenitic cast iron combining resistance to corrosion, erosion and heat. "Nicrosilal."—Suitable for resistance to heat at temperatures up to 1,100 deg. C. "Silal."—Suitable for heat resistance at temperatures up to 950 deg. C. High Silicon.—Suitable for resistance to acids and other materials. Nickel Alloy Cast Iron.—Suitable for oil hardening and tempering to give a hardness of 500 Brinell throughout thick and thin sections. A wide selection of castings made in the above materials is exhibited showing suitable applications.

**The Soldo Company,** Sicilian House, Southampton Row, W.C.1.—This exhibit features "Soldo," which is non-acid and consists of a powder containing a combination of fluxes and metal. It is free from both lead and mercury, and is an innovation in tinning and soldering in that all metals, except aluminium, whether rusty, corroded, greasy or oily, without prior preparation beyond the application of heat and "Soldo," can be permanently and effectively tinned. Included amongst the metals hitherto either difficult or impossible effectively to tin, but which "Soldo" can deal with effectively, may be mentioned blue planished steel, nickel-chrome steel, Staybrite steel and other stainless steels, Stalloy, cast iron, cast steel, chromium-plated metals, etc.

**Tensometer, Limited,** 73, Southampton Row, London, W.C.1.—The Tensometer testing machine, to which this stand is devoted, is arranged for taking tensile and notched-bar tests with autographic records of each test. In each tensile test the yield point, maximum and breaking stresses can be read without calculation from the autographic record.

The Tensometer is also arranged for taking Brinell hardness tests. The elongation and reduction in area percentage of the tensile test pieces are read without calculation from universal gauges provided. The notched-bar record shows the value in impact by its area and by its shape. Accuracy in cutting the notch of the notched bar test piece is ensured by the cutter and jig which are provided with the notched bar apparatus.

Eight different styles and sizes of tensile test pieces can be tested. These have sections ranging from $\frac{1}{1000}$th of a sq. in. in area to $\frac{1}{4}$th of a sq. in. in area, according to the maximum stresses of the materials to be tested. Extra equipment can be provided for a cast-iron bend test by which the breaking stress shown by a tensile test is read off a scale without calculation.

Three types of machines—100 ton, 50 ton and 25 ton—are made, in which the maximum direct pulls exerted are respectively 2 ton, 1 ton and $\frac{1}{2}$ ton to suit the materials to be tested. Every machine has the autographic recorder fitted ready for use.

**Henry Wiggin & Company, Limited,** Wiggin Street, Birmingham.—Most of the exhibits demonstrate some of the principal applications for which Monel Metal is used in the shipping and engineering industries, on account of its high strength and resistance to corrosion. These include Monel Metal turbine blading, valve components, corrugated joint rings, propeller shafts and motor boat fittings, nuts, bolts and screws, miscellaneous castings, etc. Sinks and drainboards in Monel Metal for ships' galleys are also included, while the uses of pure nickel are illustrated by cooking utensils and water meter components.

The exhibits also comprise a representative selection of the well-known Wiggin electrical resistance alloys, including Brightray, Glowray, Dullray and Ferry. Spoon and fork blanks in nickel silver are another important part of the company's products which will be represented.

**Wild-Barfield Electric Furnaces, Limited, and G.W.B. Electric Furnaces, Limited,** Elecfurn Works, North Road, London, N.7.—The new "T.R.T." tool-room tempering equipment is being shown for the first time on this stand. This equipment, whilst incorporating all the main features of the production model, is smaller and has simplified equipment, and is designed primarily for tempering carbon steels and secondary hardening of high-speed steels in tool-room work. The whole unit is mounted on one framework, making a compact and convenient design. As a high output is not required in such a furnace, the charge progress recorder is omitted.

A full production type, complete with the Wild-Barfield Foster patent charge progress recorder, is shown in operation. This latter instrument not only controls and records the furnace temperature, but, in addition, gives a definite record of the rate of heating the charge and shows when it has reached the desired temperature. The great difficulty experienced in determining this state is thus entirely eliminated.

These large production units are used for all heat-treatments requiring temperatures up to 700 deg. C., and tempering, secondary harden-

(*Concluded on page* 149.)

# The Works of Samuel Osborn & Company, Limited.

Among the works to be visited by members of the Iron and Steel Institute to-day in connection with the autumn meeting at Sheffield this week, are those of Samuel Osborn & Company, Limited.

That even the steel industry is not wholly void of romance is made evident by the history of Samuel Osborn & Company, Limited. The founder of the company, the late Mr. Samuel Osborn, started his business life as a draper's apprentice; later he entered the employ of a firm of cutlery manufacturers, and his next position was commercial traveller for a steel-works. However, at the early age of 26, he determined to launch out for himself, and in 1852 he opened a small factory at 180, Broomhill, where he commenced the manufacture of files, the works covering an area of 734 sq. yds. Of course, in those days all files were made by hand, and the works found employment for 30 men and women.

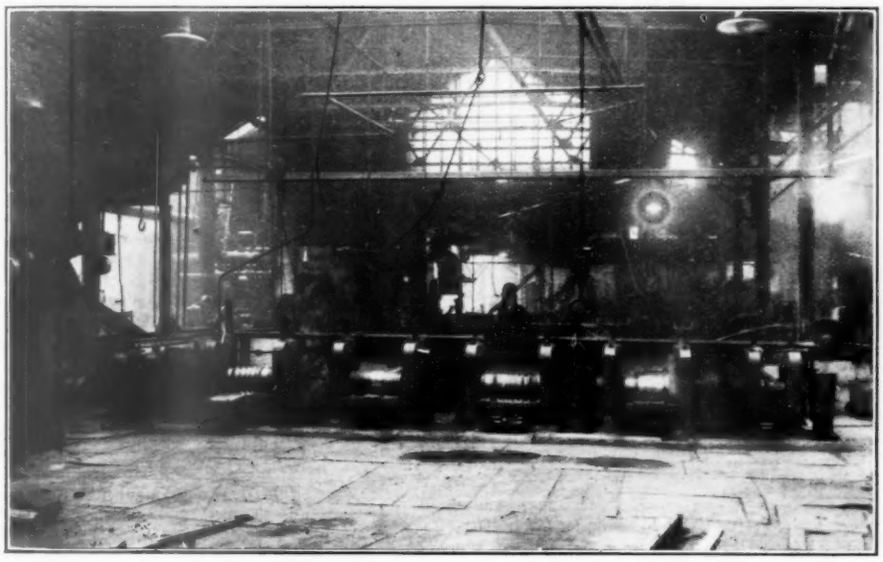


Fig. 1.—View in Rolling Mill at the Works of Samuel Osborn & Company, Limited.

The manufacture of crucible steel was commenced in 1856 in Carver Street, Sheffield, where Mr. Osborn worked a 6-hole crucible furnace. At about the same time additional land was acquired adjoining the Broomhill Works and the range of manufactures extended considerably, tools, hammers, spanners, screwing tackle, etc., being amongst the productions. A year later Mr. Osborn rented a crucible melting furnace at Pea Croft and also a tilt and forge at Philadelphia Works, a site since acquired by the company.

The late Samuel Osborn was also the first of the Sheffield manufacturers to adopt the file-cutting machine. In defiance of the pronounced antagonism alike of manufacturers and users, his foresight was justified, for there are comparatively few hand-cut files to-day.

The Wicker works, "The Clyde Steel Works," with an area of 10,179 sq. yds., were acquired in 1868. Some three years later Samuel Osborn became associated with Robert Forester Mushet, an association which had a considerable influence upon the world of engineering. Mushet's early operations had been conducted at Coleford, Gloucestershire, but in 1871 the sole rights to manufacture Mushet steel were acquired by Samuel Osborn & Company.

The premises now known as Rutland Works were purchased in 1885 and a melting plant was put down consisting of two Siemens acid furnaces of 2 and 10 tons capacity respectively and a 24-hole crucible furnace. A moulding shop was built. The existing machine shop was entirely re-equipped and for the next few years alterations were constantly in progress, whilst in 1891 a third Siemens furnace was added.

The business was converted into a private limited company under its present style in 1905.

In 1911 the manufacture of tramway points and crossings in "Titan" manganese steel was undertaken and a new company, the Titan Trackwork Company, Limited, was formed to develop this trade, the whole of the shares of the company being held by Samuel Osborn & Company. The manufacture of rustless steel was commenced in 1916, and this was followed in 1918 by rustless iron and later, in 1924, by "weatherproof" iron. The business was converted into a public limited liability company in February, 1920.

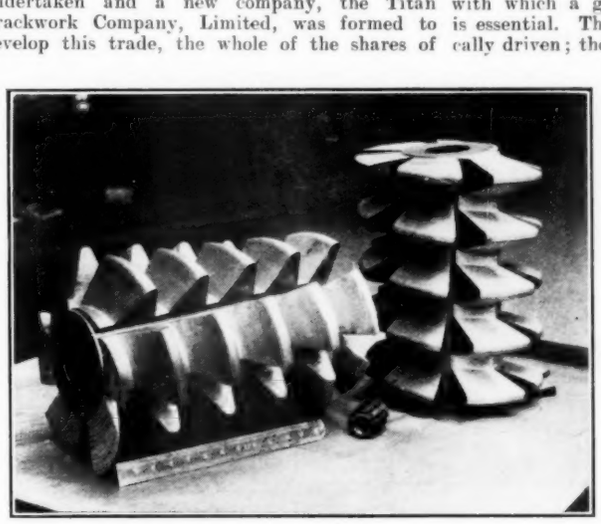


Fig. 2.—Large Pair of Hobs.

During the succeeding years the progress of enlarging and improving the works and plant has been continuous, and in 1923 the new spring shop was opened at the Rutland Works. The shop is designed and equipped to produce 3,000 tons of finished laminated springs per year and is amongst the finest shops in the kingdom devoted to spring manufacture.

From the foregoing it will be understood that Samuel Osborn & Company, Limited, now control four large works, of which the Wicker works is devoted to the manufacture of steel, small tools and twist drills. The main foundry is at the Rutland Works, Neepsend, where also is situated the subsidiary company, the Titan Trackwork Company, Limited. The Broomhill works are devoted to the manufacture of files, and the Regent works to the production of forgings and sheet rolling.

### Clyde Steelworks.

As already stated, the Wicker works are devoted to the production of high-speed steels and special alloy steels, and to the manufacture of small tools, twist drills, milling cutters, etc.

The melting plant is housed in two shops. No. 1 shop contains three Héroult electric furnaces of 3 tons, 2 tons and 15 cwts. melting capacity respectively. The ingots are top or bottom poured, according to requirements, and the casting floor is served by a 5-ton Vaughan and a 7-ton Morris crane. No. 2 melting shop is devoted more particularly to high-speed steels, special alloy and stainless steels. It is equipped with a Met-Vic high-frequency furnace of 5 cwts. melting capacity. In this furnace a heat is got down in 1¼ hrs.

The cogging shop, in which the ingots are cogged down into billets, is served by seven steam hammers ranging from 8 cwts. to 3 tons. Both gas- and coal-fired furnaces are in service, the last named being equipped with waste-heat boilers. A feature of particular interest in this shop is the forging of the finished bar from the billet under the hammer. At the time of our representative's visit, hexagon bars of tool steel were being so forged, the accuracy to size and excellence of finish testifying to the skill of the craftsman, for such work surely is craft of a very high order.

The rolling-mill plant comprises five mills, of 12 in. 10 in., 9 in. and 8 in. respectively, these mills rolling to sections the high-grade steel, with which a good finish within narrow limits is essential. The three smaller mills are electrically driven; the 12-in. mill is driven by a steam engine, the steam for which is raised in waste-heat boilers heated by the coal-fired mill furnaces. It is worthy of note that the whole of the mills have been worked full shifts during the past eight years.

The heat-treatment plant is housed in an annexe to the mill and here are installed nine furnaces in part coal- and in part gas-fired, a complete system of temperature control and recording being in operation.

The small-tools shops are laid out with modern tools for the economic production of twist drills, milling cutters, reamers, hobs, etc. We illustrate a pair of hobs recently turned out at the works. These hobs are the largest of their type produced in this country. They are single thread, right and left hand, designed for cutting nickel-chrome steel. Made of the company's Mushet high-speed steel, they are 11 in. dia. by 15 in. long, one diametral pitch, 2½ in. bore.

It is interesting to note that there are 23 processes in the manufacture of a twist drill, and the work is checked after each process, a system which not only ensures accuracy of workmanship, but prevents further work being done

on pieces which would have to be thrown out on the final inspection.

The heat-treatment shop is well in line with the very latest practice. The plant installed includes:—Lead pots, Richmond gas-fired preheating furnaces, Chesterfield furnaces, Lucas furnaces with high- and low-heat chambers, and Wild-Barfield air tempering furnaces with automatic controls and switches.

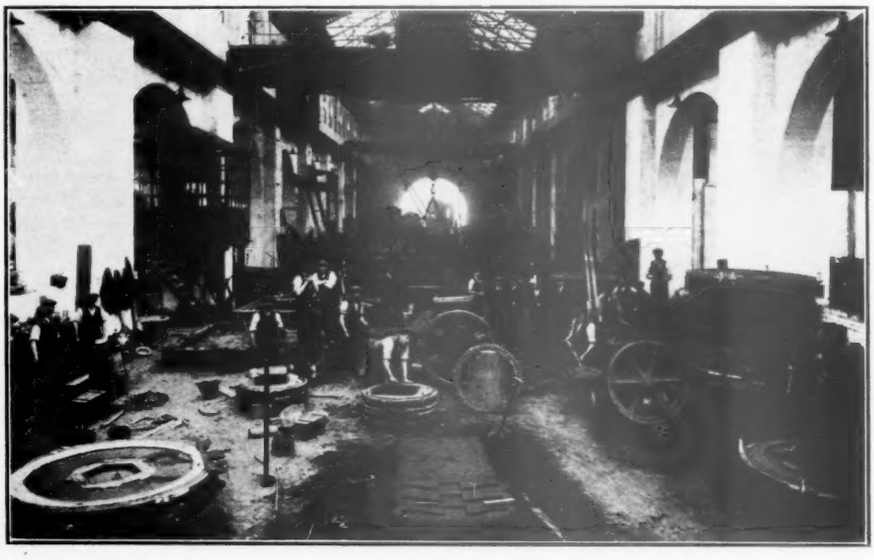


Fig. 3.—View in the Steel Foundry at the Works of Samuel Osborn & Company, Limited.

There is a well-equipped laboratory adjoining the test-house, which last contains two Avery and one Buckton testing machines, upon which all the usual physical tests can be carried out. In an adjoining shop is a Lucas heat-treatment furnace which, for the most part, is used for experimental purposes.

Fig. 4.—Laminated Spring Shop at the Works of Samuel Osborn & Company, Limited.

### Rutland Works.

At Rutland Works is situated the steel foundry, the chief production being manganese steel and other special-alloy steel castings.

The whole of the original melting plant, consisting of Siemens acid furnaces, has been dismantled and their place taken by two Tropenas furnaces, each of 2½-tons capacity. Each furnace is served by a 50-cwt. capacity cupola. The furnaces, generally worked alternatively, receive the metal from the cupola by a swivelling spout. There is a "bay" cupola for melting the additions. Experiments were carried out with a reverberatory furnace for melting the ferro-manganese, but owing to the intermittent method with which this had perforce to be worked, it did not prove economical. The ferro-manganese is, therefore, melted in a 12-hole crucible furnace in an adjoining shop and carried to the Tropenas plant.

In a separate building are housed two Héroult furnaces of 30-cwt. and 15-cwt. capacity respectively, the main output from these furnaces being in the form of heat-resisting steels.

In the foundry a Booth jib crane handles the ladles from the furnaces to a point where they are picked up by one of the shop cranes. There are six of these cranes, by Broadbent & Vaughan (viz., two of 25-tons, two of 10-tons and two of 5-tons capacity). The major portion of the castings being of a special nature, hand-moulding is employed; there are, however, four MacDonald jolt machines, which will take boxes up to 50 cwts. and also a Whittaker gear-moulding machine.

The drying stoves comprise two by Priests Furnaces, Limited, which are coke fired, and have proved highly economical and efficient, and two Hislop coal-fired furnaces. In the electric-steel foundry there are four Hislop coal-fired furnaces. In this foundry, also, it may be noted, there is a 12-hole crucible furnace, which may be used if required. The cores generally are hand-made. The two drying stoves, designed and built by the works staff, are fired with town's gas on the Keith-Blackman system.

There are two gas-fired and one coal-fired furnace for the heat-treatment of the manganese-steel castings.

Liberal provision has been made for the storage of sand, and generally the Yorkshire moulding sand is air dried. Provision, however, is made for further drying on hot plates, if necessary. The silica sand is treated in a Kelbus sand drier by the Transport, Engineering & Equipment Company, Limited, of Leeds, and is equal to drying 10 tons per day. It is of very simple design, the outstanding feature being the arrangement of the heater element. Instead of the one central element, there are four heater pipes passing from the firebox to the flue, thus appreciably increasing the heating surface. An internal sieve grating prevents stones and wet sand from falling to the base of the hopper and clogging the outlets and allows free passage of the heat to the wet sand. The sand is mixed in an improved type of runner mills.

In the fettling shop are three Tilghman's sand-blast plants and a battery of high-speed grinders, the 24-in. wheels having a peripheral speed of 9,000 ft. per minute. These machines are built by the company. There is a complete installation of pneumatic tools, as also of oxy-acetylene cutting apparatus. The pattern shop is a particularly roomy and well-lighted building, in which a full range of modern wood-working machinery is installed. There is a well-laid-out machine shop, equipped with standard tools, which do not call for any special mention.

### Regent Works.

The Regent Works are given over to rolling sheets in carbon, rustless and alloy steels. The ingots are cogged down for the mills under two forge hammers of one and two tons respectively. The mill plant comprises a 22-in. mill consisting of one stand of cogging and one stand of finishing rolls, capable of rolling sheets up to 4 ft. wide, and an 18-in. mill consisting of one stand of cogging and two stands of finishing rolls capable of rolling sheets up to 3 ft. wide.

The furnaces range from the Sheffield coal-fired sheet-mill furnace to the latest type of Priest sheet-mill furnace, these last embodying special features by which very close control of temperature and furnace atmosphere can be maintained. The mill auxiliaries include multiple roller flattening machines, hydraulic stretching machines and shearing machines, etc.

The manufacture of laminated springs forms a very important branch of the company's activities, the shops being well laid out for economic mass production, spacious and well lighted.

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**Blast-Furnace Practice.**—In the "Archiv des Eisenhüttenwesens," K. Goethe, J. Stoecker and M. Paschke discuss the effect of the silica content of iron ores on the smelting costs. E. Wengel and A. Salesnew, in "Stal," deal with the influence of the mode of preparing the charge on the progress of the reactions in the blast furnace, making special recommendations suitable for Russian practice, while in a further Paper in the same journal E. Wengel describes the results of a blast-furnace tests at the Sulin works, using anthracite and coarse ore, the proportion of anthracite being varied up to 60 per cent. of the whole charge.

# Falkirk Foundrymen at Shotts Ironworks.

Nearly 50 members of the Falkirk Section of the Institute of British Foundrymen visited Shotts Iron Works on September 1. They were conducted in groups by the officials of the company through the various departments. Starting at Northfield Colliery, where the entire plant is driven by electricity supplied from the company's central power station, they showed much interest here in the very fine installation of pit baths and the modern stable for the pit ponies. At the iron furnaces they witnessed the charging of the raw material at the top of the furnace, and were much interested in noticing the use of Scottish ironstone and coal fuel. These are almost the last furnaces in Scotland now making this high quality of Scottish pig-iron, for which they are famous.

After witnessing the casting of the pig-iron and the method of storage, every cast being arranged according to analysis and numbered systematically for sales purposes, they proceeded to the power station, which generates high-tension current for all the company's collieries. Here they witnessed the steam being generated by the furnace gases after all the by-products, such as sulphate of ammonia, pitch and creosote oil, had been extracted. This current is transmitted by several miles of transmission lines to the various pits. They made an inspection of the two brickworks, making composition and grey brick from the company's waste products, the two works having a capacity of nearly 60,000 per day.

Adjourning to the works offices, which are built entirely of Shotts grey bricks, the visitors had the opportunity of inspecting a good exhibit of the company's various products, including many varieties of coal (among which was the well-known Fortissat Blackband), ironstone, pig-iron, limestone, bricks, hydrated lime and poultry grit, etc., and also the recently introduced cast-iron road foundation plates, which are in use in Lanarkshire and in London.

The visitors were thereafter entertained to supper in the conference room of the works' spacious offices, with Mr. Matthew Brown, managing director of the company, in the chair.

In the course of the evening, MR. J. M. PRIMROSE, of the Grangemouth Iron Company, ex-President of the Branch, expressed their pleasure in having seen so many interesting operations, and thanked the Shotts Iron Company not only for the opportunity that had been given them to see the operations, but also for the company's hospitality. Each one there was intimate with the company's products, particularly pig-iron, and they were now aware that the hospitality of the company was of the same high order.

### Early Beginnings.

MR. MATTHEW BROWN, in expressing the pleasure that he and all the other officials had in having the Falkirk foundrymen with them, said that, in accordance with the desire expressed, he might touch a little on some points in the company's history of possible interest to all those there so closely associated with the iron trade. Several centuries ago any small amount of iron required in Scotland had to be imported. England produced considerable quantities, which increased during the reign of Queen Elizabeth prior to the Spanish Armada. Pride of place had, however, in Scotland to be given to the Carron Iron Company, who were the first in this country to establish furnaces. These were followed by Clyde, Calder, and in 1801 the Shotts Iron Company was established, with furnaces and foundry at Shotts. Many changes had taken place during the last 130 years. The output per furnace was now enormously increased. The introduction of the hot-blast method in the 1830's had meant a big reduction in the fuel consumption, and strong efforts continue to be made to constantly lower the fuel consumption per ton of pig-iron and so reduce cost.

### Technical Developments.

The introduction in the 1870 decade of the closed-top furnace for recovery of the gases, and at a later stage the installation of by-product recovery plant for the recovery of the by-products from the furnace gases, had all meant very considerable advances in the progress of pig-iron smelting. When four of the Shotts furnaces were in blast, the gases therefrom (after they had been treated in the by-product plant) were sufficient when fired under the boilers to raise all the steam required for the production of electricity by the generating plant they had seen. The collieries were linked up to this generating plant by many miles of transmission lines.

The company at one time had an extensive light-castings trade, and in addition to a foundry at Shotts, had a second one at Calton in Edinburgh, and also the Springfield Foundry in Leith Street, also in Edinburgh. A relic of these old days is still visible at the Springfield Foundry in the form of the iron gates. Their trade for these castings extended practically all over the world. At a later stage the company manufactured a considerable tonnage of pipes, but as time went on it was thought desirable to eliminate these other branches, as the light-castings branch seems to have been stopped about 1880.

For many years prior to 1825 there were no railway facilities. The ore and pig-iron had all to be transported by means of horses and carts, and some of the incidents of these Knights of the Broad Highway are exceedingly amusing, and all are intensely interesting. There are many records from which one can more or less reconstruct the mode of living of the workers in these far-off days, and there were disputes between employers and employed then as now.

### Future Prospects.

Referring to the present time, he said that the heavy industries had been passing through a time—in fact, years—of more or less deep depression, as had the general trade of the country. Efforts had, however, been continually made so to improve manufactures and reduce costs to meet foreign and other competition that to-day he thought the iron trade—and with that he included the foundry industry—was in a position to take advantage of any increase that came along. They in the light-castings industry had had their periods of depression, but he thought he was safe in saying that never to the same depths as the coal and pig-iron trades had suffered, and, as a matter of fact, he was glad to know that their trade had benefited very much recently, presumably following increased housing activities. He hoped that increased trade would continue, and that the Falkirk district would increase in the prosperity with which it seemed always to have been associated. He complimented the Institute of British Foundrymen on their virility. The pig-iron trade had every reason to realise that technically the Institute had made great progress. In the old days to which he had been referring it was sufficient to break a pig and to decide that the fracture was either Nos. 1, 3 or 4, or forge, and to despatch in accordance with the order for either one or other of these numbers. To-day, however, it was entirely different. Specifications were issued from the laboratories of the founders from men who had studied the mixing of iron in the cupola, and these specifications, depending on the class of manufacture they were for, stated very clearly that the iron must have a certain percentage of silicon, and so on. They at Shotts had atttained the position in their pig-iron production of being able to meet the most severe specifications and to give pig-iron with what he might term "body." The members would have seen to-night in going around the furnaces that, while there was one furnace ready to be fired with coke to give more than the double production of the others, the furnaces on purely foundry pig-iron still remained of the old type, fired with coal. He at all times maintained the opinion that iron from a slow-smelting furnace for certain foundry purposes, especially for heavy castings, was the best. He had a feeling that trade had turned the corner and, although the improvement was very slow and while it may not be so obvious now as in the past when the trend of the Scotch pig-iron trade was a fair indication as to the trend of trade generally, he had still sufficient faith in that index, and so far as his company was concerned they had been booking considerably increased business, and he personally was looking forward to the immediate future with feelings of considerable optimism. They, at any rate, were continuing the furnaces which, with two short spells excepted, had now worked for so long.

MR. MORRISON, Secretary of the Falkirk Branch of Foundrymen, replied to the toast of "The Institute of British Foundrymen," proposed by MR. A. S. MURDOCH.

MR. COWAN, of the British Cast Iron Research Association, made kindly reference to the Chairman, and to his experiences in using Shotts iron. This closed what was declared to be a most enjoyable and instructive visit.

## Shipping, Engineering & Machinery Exhibition.

(*Concluded from page* 146.)

ing of high-speed steel, heat-treatment of aluminium alloys, and other non-ferrous material, are thus covered by the range.

A range of Wild-Barfield "Heavy-Hairpin" box-type furnaces has been introduced, and one of the standard sizes is seen in operation. The salient feature in these furnaces is the patent arrangement of the heating elements, which, as the name implies, are of heavy section nickel chromium rod in the form of a hairpin. Whilst the life of these heating elements when operating at high temperature is second to none, the question of replacement will arise after many years. Each individual element can be replaced by the actual user at a low cost, and furthermore, the "Heavy-Hairpin" design renders such replacement possible without waiting for the furnace to cool.

Other furnaces in operation include both vertical and horizontal automatic hardening furnaces. These furnaces are fitted with the Wild-Barfield electro-magnetic indicator, which shows when steels being hardened reach the critical point. For all carbon-carburised, and low alloy steels, the quenching point is coincident with the critical point, and thus a definite indication is given when the steel is ready for quenching. Elimination of spoilt work and the best possible grain structure giving greatest hardness are definitely ensured.

A high temperature furnace for high-speed steel hardening and a full range of laboratory muffles will also be in operation. A Vickers hardness-testing machine will be demonstrated and samples of work carried out in a new type of bright anealing plant will be exhibited.

The associated company is showing hardening compounds, such as "Eternite," the well-known box-hardening compound, "Kleenard," the open-hearth compound, and "Nokase" anti-carburising mixture. In the past the latter material was only made in clay form, but it is now available in paint and clay.

**Czecho-Slovak Blast Furnaces.**—Of the 27 blast furnaces built in Czecho-Slovakia, five were in blast at the beginning of the year, while now seven or eight are producing pig-iron. At least eleven of the remaining furnaces are antiquated and hardly suitable for the economic production of pig-iron. Plans are now being prepared to demolish a number of these furnaces and reconstruct the others.

XUM

# Foundry Selling Practice.

## MORE WASTED OPPORTUNITIES.

**By Eric N. Simons.**

In a previous article the opportunities lost as a result of not handling inquiries correctly were discussed. It is now proposed to turn to another great source of overlooked possibilities—the quotation. Everybody has received a quotation at some time or other, and has, perhaps, never analysed, though he has been influenced by, his reactions. But to most, when quoting, the quotation is just telling someone who isn't very interested a price for material in which the seller is not very interested himself. That, at all events, is the impression which many foundry quotations would make on any recipient who cared to study his impressions after receiving them.

Now what is the quotation? Admittedly it is, in essentials, letting a customer know what he will have to pay for goods he requires. But in selling it is far more than that. First of all, it is the doorway through which one must go to get the account or the order, and according to the manner in going through that doorway is one judged, just as a salesman is judged when he enters the office of a buyer who knows his job. Secondly, it is a means of showing the customer just how far the seller does or does not know his own job. The way in which the quotation is couched will clearly indicate to a skilled buyer how far the seller is genuinely familiar with his requirements, and how accurate is this understanding of how the castings will meet them.

### Analysing the Buyer's Mentality.

Thirdly, the quotation reveals in a large measure the keeness of the seller's interest in the buyer's order, and because nearly every man likes people to be interested in his actions, even though they may be utter strangers to him, a purchasing official enjoys the sensation that an intelligent interest is being taken in his requirements.

Again, the quotation can be used as a vehicle to draw the attention of the buyer to other products of the foundry, and if discreetly used, is extremely valuable for this purpose, since it goes straight to the man who matters. It can be so designed as to simplify in many directions the problems and work of the purchasing official. And, finally, it can be so worded as to draw from the buyer some indication of the reason either for placing or for refusing to place the order.

### Avoiding the Stereotype.

Thus the quotation is a valuable commercial instrument simply offering itself to the sales manager. But how often is that instrument used in any other than a clumsy and ineffectual manner? The average foundry quotation too often runs after this fashion:—

"Dear Sir,

In reply to your esteemed favour of the 19th inst., we have pleasure in quoting as follows:—

200 Smith's Dynamo Magnet-Steel Castings, to B.P. No. 14534 enclosed, finish-machined where marked in red on dwg., you to provide all necessary patterns, coreboxes, etc., . . . £150 lump sum, delivered your works, terms net cash, monthly a/c. Delivery 4/5 weeks, as quoted.

Hoping to be favoured by your esteemed order, to which we shall give prompt and careful attention, we are,

Yours faithfully,
John Smith & Company, Limited."

One may assume buyers get too many quotations of this sort to be surprised or dumbfounded by them; but the author confesses that every time one of them comes into his hands, he marvels at it. And perhaps it is as well that there should be so many, for otherwise the really intelligent quotations, in which every possible opportunity is utilised, would not stand out so clearly, and would be less immediately productive of results.

### Basic Requirements.

Having criticised the stereotyped letter, of which an example is given, it is only just to show in detail what the quotation can be made to do. First, there is the question of "entering in at the door." The first impression created by the quotation must, in short, be a good one. This is largely a matter of mechanical efficiency. The quotation paper must be of good quality, and inserted in an envelope large enough to dispense with the need of excessive folding, or to accommodate blue prints without that tearing at the corners that causes some quotations to arrive looking as if they had been used as missiles in a street fight.

Next, the typing must be clear and careful, without slovenly slapping out of wrong letters, excessive and smudgy rubber-work, inadequate margins and careless spelling. To put a cheap junior on to quotation work is false economy. Spacing should be open, with some consideration for the failing sight of the elderly, so that, on the whole, beautiful as élite type single-spaced can be, if the quotation is a long one it may be better to sacrifice it for the normal double-spaced type. Price should be inserted or underlined in red, and should stand well away from the body matter of the letter, so that it can be clearly picked out. Where enclosures and tracings or prints are attached to the estimate, it is a good plan to keep a supply of folders handy, into which the quotation can be slipped in its entirety. This keeps the sheets together, enables them to be handled as a whole by the buyer, and prevents their getting mislaid, besides giving a good first impression.

Customers' references should never be omitted. Many a time a quotation addressed to a large firm wanders about for a day seeking an owner, simply because the reference has been omitted, and meantime the order is being settled. Similarly, one should make sure that personal references are clearly and accurately indicated, so that return correspondence from the customer does not get delayed for the same reason.

A quotation which is obviously the result of careful intelligent work always creates a good impression, but this is often ignored by estimaters.

### Intelligent Anticipation.

Now comes the task of indicating to the customer by implication that the seller knows his job. This opportunity does not invariably occur, but it occurs often enough for its neglect to be noticeable. For example, how often it happens that the customer orders castings without specifying the exact quality of the material, though he may mention the purpose. The foundry quotes for what it considers the best material for the job, and leaves it at that. It says:—"4-in. steel castings for pumps, price so much." Jones get a lower quotation from someone else who has quoted for a less efficient material, and places his order at this latter figure simply because the first foundry has not taken the trouble to educate him. If only Foundry No. 1 had quoted on these lines:—"We note these castings are required for gravel pumps. For this purpose we strongly recommend our manganese steel, which is particularly designed to resist the wear and abrasion caused by the presence of gritty matter. The enclosed booklet tells you everything you need to know about this steel, and explains why it is worth the slightly higher cost. But if you do not feel inclined to pay this small extra, then we can offer you castings of excellent quality in our special chrome alloy steel, which, etc., etc." In this way the customer learns that you really do know what you are talking about. Furthermore, you put him in the position of being able to go to Foundry No. 2, and say:—"Look here; what *are* these castings you've quoted me for? Are they manganese steel or chrome alloy steel or what?" The seller strengthens his position vis-à-vis other foundries, and his own at the same time. Give the customer all the alternatives. Do not leave it for him to tell you "This material will not do; what else can you offer?" Granted the seller may wish to sell him the better-quality material, and perhaps feel disinclined to let him know he can get less costly castings. But if the seller does his work properly, he will make him want the higher-priced castings for definite and excellent reasons. *That is selling.*

Then comes the task of convincing the buyer that the seller wants his order, and is genuinely interested in it. This largely depends on reading his inquiry carefully and making sure none of his queries are left unanswered. It means trying to visualise him and his difficulties and taking a little extra trouble to meet them if possible. It means saying, not "We note your query as to the ability of our stainless steel castings to stand up to strong oxalic acid, and can assure you you will find them perfectly satisfactory in this respect," but "You will naturally wish to have some data concerning the ability of our stainless steel castings to withstand the conditions you outline. Here are the results of a series of tests carried out on oxalic acid in strong solutions. Immersed for 48 hours at a temperature of . . . " etc., etc. It may mean on occasion telling the buyer frankly that one cannot guarantee to meet his requirements, especially where delivery is concerned. And, above all, it means conveying by the courteous, businesslike, and efficient tone of the quotation that the seller genuinely wishes to serve him and secure his work.

### Widening the Scope.

Then there is the task of discreetly conveying to the customer that the seller has other products in which he may be interested. One may slip in a little leaflet or folder with the offer. One may make the quotation itself carry a list of your other products attractively displayed, or a small "sticker" of an advertising kind may be affixed to one corner of the form. But, undoubtedly, the cleverest way is that adopted by one large steel foundry. After quoting for steel castings, this foundry adds a footnote:—

"To facilitate the machining of these castings, we recommend the use of XYZ super-high-speed steel. On similar castings in our own machine shops we obtained speeds and feeds as under. . . . We should like to have the opportunity of quoting you for this steel, or, alternatively, of sending, together with the castings, a trial tool which you can use on them."

Simplifying the purchasing official's work is largely a matter of attention to detail, and consists in seeing that important points are not omitted. If the price includes patterns, say so. Define accurately any stipulations or conditions in regard to delivery, payment, packing, shipment, and so forth. Instead of saying: "Delivery 4/5 weeks," which is vague and careless, why not say: "These castings will take approximately 5 weeks to manufacture. We shall put the patterns in hand at once and hope to begin casting on September 19. Allowing X days for machining and shot-blasting, delivery should begin with a batch of 50 on September 30, following with batches of 30 per week until completion." Think how much more convincing

(*Concluded on page* 152.)

# Runners and Risers.

By T. R. Harris.

Amongst the many decisions a moulder is called upon to make, those relating to runners and risers are by no means the least important. The question, "Where should it be run?" is one that is often asked and which sometimes fails to receive due consideration. No matter how well made and highly finished a mould may be, or how suitable the metal is for the job in hand, unless good running arrangements are provided, the success of the job will be doubtful. Some think that a runner is just an opening for the entry of the metal, and so construct their runners accordingly, with no consideration for its size or position, and wonder at their poor results.

### General Considerations.

It is advisable to run a job so as to get as near as possible even cooling throughout the casting, thus eliminating contraction stresses, drawn places and similar faults. To achieve this object it is necessary to run in the lightest section of the casting, which ensures this position remaining hot while the heavy bosses or lumps are imparting their excess heat to the mould, so that each cools off together, resulting in a "sound" casting. Another important point is not to run into a machined face of any casting, if at all possible, for invariably if a casting has been run on a machined face it shows up rather badly after the machinery operations are completed. There are two reasons for this, the first being that the sand over which the runner passes is heated up considerably during the passage of the metal over this point, and thus, on cooling, the heat being retained for a considerable while causes a miniature "draw" or opening up. The second reason advanced is that if any dirt should enter into the runner with the stream of metal, it finds a lodging place just inside the casting in front of the runner, and fails to move. This may be observed when casting open sand jobs, especially moulding box parts, when it will be noticed that the dross always keeps just in front of the runner. Whatever may be the reason, it is always best to "run" remote from a machined face. The size of runners is also an important point, and is governed by the type of job in hand, for different jobs require different speeds of pouring. For instance, a job with a large number of intricate cores in would have to be poured slowly to allow of the easy exit of the gases generated during casting, whilst a plain, flat plate with a large top surface would be required to be run much quicker, to avoid the top "scaling down." Runners for a job run from the bottom would require to be larger than if the same job was run from the top, and also runners for a job in dry sand need not be so big as if it was made in "green sand." In practice each job has to be considered on its own merits, whether there be many cores, large top surface, or other considerations.

### Typical Examples.

Fig 1 shows three views of a common type of bracket, the lower view showing the runner "down gate" and also the "ingate" at right angles to it; this needs no elaborating upon; B in the same fig. is a riser. There are two main functions which risers fulfil, one being to relieve the strain on a mould and the other in special circumstances to serve as a "feeder." Dealing with its first use, it is generally advisable to have a small riser on any high parts of a casting, to ensure the metal running right up in the mould, it being a way of escape for any entrapped air or gas which would tend to interrupt the metal from completely filling up a raised detail, such as a boss or lug; these risers need not be very large; on some jobs they are very small and are referred to as "pop gates."

The second use is one which is of great value in jobs of varying section in that it can be used as a reservoir to supply the heavy parts of the job with live metal to make up the deficiency due to shrinkage. This type of riser is larger than the foregoing and can be used in two ways, the first by using a feeding rod and the second by making the "head" so much bigger than the heavy part of the casting so that it feeds itself and is therefore known as a "self- feeder." If the former method be adopted, a moulder can use a $\frac{1}{4}$-, $\frac{3}{8}$- or $\frac{1}{2}$-in. bar according to the size of the job and, after heating it, would gradually work it up and down in the riser and casting, always keeping a hole open to the live metal on top. This is kept up until the casting has solidified, and such a riser is shown in Fig. 8 at A. This job of feeding is one that takes a considerable amount of energy out of a man, and on some jobs this could be entirely eliminated, as will be shown later, by adopting a different form of runner. In Fig. 1 the metal, on descending the "down gate," immediately fills the mould, carrying any dirt with it which might have entered. For very important work this would be fatal, so some form of trap for dirt has to be adopted. One method of accomplishing this is to make the runner-basin large enough to take all the metal required for the job, and keeping the "down gate" closed by a "stopper" until this basin is filled. All the dross floats on top, and on lifting the stopper clean metal flows down.

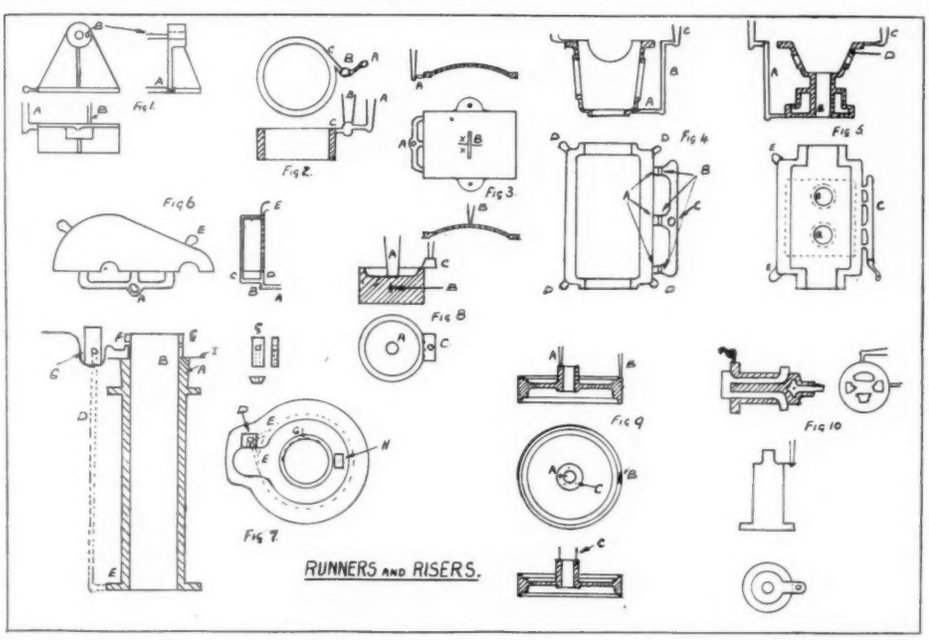
Sometimes filter cores are used to accomplish the same object, but Fig. 2 shows a runner which ensures clean metal entering the mould. The sketch shows a cylindrical casting which is required to be machined all over. It is cast over length for holding in the machine, and incidentally this excess is used as "head" to catch any dirt which, in spite of the special runner, may have entered. It will be noticed that the ingate C is tangential to the circumference of the job, this being far superior to cutting the runner in straight, which would probably cause erosion of the sand and result in a dirty casting. The special portion of runner as shown is the spinner B. Metal enters by way of the down gate A and travels along the channel, which gives it a spinning motion at B. All the dirt, being lighter than the metal, is thrown to the centre and goes up the riser B. The clean metal, being drawn off from the bottom by means of runner C, enters the mould comparatively free from dirt. Good results accrue from the use of this spinner, and it is well worth the extra work for important jobs.

### Thin Cover Castings.

Fig. 3 shows a different type of casting, it being a thin cover with large surface area. If run in the ordinary way by a spray runner it results in cold shut at x x. The best type of runner for this job and others of a similar type is the wedge runner shown at B in the lower view, run direct on top on to the pod. Fig. 4 is an example of bottom running in connection with a large casting. There are many factors to be considered before deciding on top or bottom running for jobs of this type, as both methods have points for and against. When a job is top-poured it has a greater effect on the mould, cutting it by the prolonged rush of metal over it, and unless it be well made may give very unsightly castings. On the other hand, top-runners are easier to make and also are more dependable for a clean top to a casting. Bottom-running has in its favour the fact that the metal drops outside of the casting, thus not causing any damage to the mould. In the example shown in Fig. 4 it was this consideration which led to its adoption. It will be noticed that the metal is not allowed to drop from the runner box direct to the ingates A, but is broken on the joint of the mould and forms a channel which feeds three further downrights B, these in turn feeding the three ingates A. In this instance three runners are used, it always being best to use a quantity of smaller runners than a few large ones. Risers to relieve strain during casting are shown at D. While the foregoing was successful, the method shown in Fig. 5 and run in the same way proved a failure. This example is a double-cylinder, water-jacketed body cast integral with a part of the crankcase. When run as at A, trouble was always experienced in the boxes at B at the same side as the runner. Success was obtained through using the runner C, the mould being well made at D to withstand the wash of the metal.

### Multiple Running.

Fig. 7 illustrates a combination of top and bottom running; this sketch shows an air-pump body, but the method is also applicable to cylin-



ders, which have to have a clean bore and flanges. D is the down runner, and ingates are splayed as shown at E. A is a "head" and is rod-fed through H. On top of the "head" is a cast-iron ring I about ⅜ in. clear of the main core which projects 9 in. above the top of the "head." Around the main core and on the cast-iron ring is placed a series of cores 9 in. by 3 in. by 1 in. with a hole through, as details at G. Every third one of these has a channel cut out to form the top gates. The runner-basin is built fairly deep with a core C connecting the down gate D at right angles, to break the fall of metal, and a channel is built around the cores G, as at F. When pouring, riser H is closed down and about half-a-ton of metal poured through D into the bottom flange. The pouring speed is then increased and channel F overflowed, thus bringing runners G into operation. These runners fall on to the ascending column of metal and the latter breaks it up and enlivens it. When the mould is filled, riser H is uncovered and the job is rod-fed.

Fig. 6 illustrates another combination of top-and-bottom runners for a different reason from the foregoing. In Fig. 7 both are used to ensure a good clean bore, and flanges which have to be machined, whilst in Fig. 6 the job is of thin section and of large surface area, which, if care was not exercised in the positioning of the runners, would result in cold-shuts or patchy places due to bubbles of air from the core. The sketch is self explanatory, A and B being the down-runners, C and D the ingates, while E-E are the flow-off risers. Fig. 8, which was mentioned when dealing with feeding, is a job which caused much difficulty at first. It is an 8-in. solid piston, but a small hole afterwards being bored through the centre. It is run direct on to the mould, as shown at A. This runner is then fed as a riser would be. Beside taking a large number of men to feed a batch of these castings, some would be returned as scrap after machining, for, on boring the centre hole, porous patches would sometimes appear due to faulty feeding, and sometimes to the reaction between the wrought-iron feeding-bar and the liquid cast iron. It was decided to make a trial casting with a block runner, as shown at C, which simply touched the casting for ⅛ in. This gave slow filling of the mould by the opening, but the block C was large enough to prevent freezing of the runner until after the mould was filled. No risers were used and the casting was entirely satisfactory.

### Eliminating Feeding.

Fig 9 is another example of feeding being eliminated; originally this flywheel was run on the boss as A with a riser at B, both being rod fed. A trial of three pencil runners, as at C, gave excellent results and has become the standardised method of running.

Fig. 10 is a sketch of a rather complicated water-cooled valve, which is required to be bright over the outside, and particularly solid at a number of bosses not shown. The first attempt at the production of this casting the author used a runner on the flange with a spinner, but it gave poor results, as quite often the castings would open up around the heavy bosses. It being impossible to get the design modified, it was decided to try to cast one on end with a runner ⅛ in. by 1½ in. The mould was made and cased up in the usual way and up-ended for casting, and gave good results, the bosses being quite sound, the castings clean, and incidently the nail which was used previously in the top to keep the cores from lifting being eliminated, no trouble was now experienced by this dropping out through not being properly fused to the body of the casting, as had happened in some of the former ones.

As was hinted at the commencement, these notes are not claimed to be exhaustive on the subject of runners and rises. For instance, no mention has been made of the horn gate, because similar results can be obtained by the use of the block runner, as shown at Fig. 8. Again, no mention is made of the question as to whether risers be closed or open during casting. Without going into details, the author would say it is a very debatable point, and would suggest closed risers for green sand moulds of large surface area, but open risers for the majority of dry-sand jobs. Again the design of the runner-boxes for various jobs has not been touched, but it is hoped enough has been said to encourage apprentices to take an intelligent interest in the subject of runners and risers.

## Carburising Cast Iron and Steel Scrap.

In a recent issue of "Die Giesserei," Dr. H. Nipper and Dr. E. Piwowarsky detail the studies they have made into the carburising action of charcoal coke, petroleum coke and graphite upon cast-iron and mild-steel scrap. About 90 lbs. of sheet-steel scrap mixed with the carburising agent were heated in a crucible to 1,500 deg. C. and kept at this temperature for one hour. After slagging a definite quantity of ferro-silicon was added, and at about 1,320 deg. C. four test-bars of 1.3 in. dia. and 27.6 in. in length, were bottom cast. In Table I the chemical analysis of the test-bars, together with the mechanical properties, are given, the latter being the average values of two to three tests. The carburising action of the agents investigated increased in the order, charcoal, coke, retort carbon, the differences being about the same. With graphite, an efficient carburisation could not be obtained, which fact was probably due to the high amount of impurities present in the graphite. These gave a slag of a very high viscosity, which impaired the intimate contact between carbon and iron. Hardness and chemical analysis show that the charcoal iron still contained some free cementite. The size of the graphite flakes increased with increasing total carbon content.

Under the same melting conditions a pig-iron containing T.C., 3.33; Gr., 2.0; Si, 1.38; Mn, 0.29; P, 0.059; and S, 0.11 per cent., was carburised. In these experiments a graphite of higher purity was used. The total carbon content of the test-bars was with charcoal about 3.6 per cent., with coke about 3.9 per cent., with graphite about 4 per cent., and with petroleum coke about 4.1 per cent. The best mechanical properties showed the charcoal iron, which gave a tensile strength of 11.6 tons per sq. in., whereas the strength of the three other melts was about the same and of the order of 9 tons per sq. in.

In further experiments the effect of size and purity of the graphite added upon the degree of carburisation was studied. The graphite which contained varying amounts of impurities was added to the raw material in powder form or in pieces. The raw material contained T.C., 2.6; Si, 1.38; Mn, 0.5; P, 0.071; and S, 0.01 per cent. From diagram, Fig. 1, it can be seen that the carburising action of the graphite, when added in pieces, increased with increasing purity, whereas with graphite powder only a slight increase could be obtained with the highest purity experimented with.

Table I.—*Relative Effectiveness of Carburising Agents.*

| Carburising agent. | Charcoal. | Coke. | Petrol coke. | Graphite. | |
|---|---|---|---|---|---|
| Composition— | | | | | |
| T.C. | 1.96 | 2.88 | 3.88 | 0.49 | 1.06 |
| | 1.88 | 2.85 | 3.83 | 0.51 | |
| Gr. | 0.79 | 1.74 | 2.82 | 0.0 | 0.06 |
| Si | 2.27 | 2.42 | 2.21 | 2.11 | 2.90 |
| Mn | 0.33 | 0.26 | 0.29 | 0.15 | 0.16 |
| P | 0.054 | 0.076 | 0.076 | 0.078 | 0.091 |
| S | 0.061 | 0.096 | 0.080 | 0.140 | 0.152 |
| Mechanical Properties— | | | | | |
| Tensile Strength .. .. tons per square in. | 19.0 | 21.65 | 11.93 | — | — |
| Transverse Strength .. " " | 33.4 | 44.2 | 23.3 | — | — |
| Deflection .. .. .. .. .. in. | 0.266 | 0.325 | 0.493 | — | — |
| Repeated Impact Strength .. Number of blows | 1,998 | 9,732 | 366 | — | — |
| Brinell Number .. .. .. .. .. | 314 | 265 | 205 | — | — |

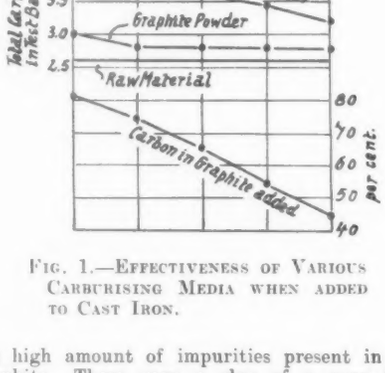



Fig. 1.—Effectiveness of Various Carburising Media when added to Cast Iron.

## Foundry Selling Practice.

(*Concluded from page* 150.)

this is to a customer than the slapdash 4/5 weeks. Of course, this takes up more space and time; but why not? This information has to be got out anyhow. Why should not the customer have it? Why should he not learn that certain processes are involved, all of which call for care and time?

The whole secret of the wasted opportunities in quoting is laziness. Everybody is fundamentally lazy and fond of routine, and if one can evolve a stereotyped formula for quotations, formula that saves the trouble of thinking, one is pleased. But that will not do to-day. Selling to-day means sweating blood to get orders, and some of that blood must come from the brain.

**Continental Wire-Rod Syndicate.**—At the quarterly meeting of the Continental Wire-Rod Syndicate, held at Luxemburg on September 7, the output quota for the last quarter of the current year was fixed at 300,000 metric tons, the same as that fixed for the current quarter. Prices have been left unchanged.

**Electrolytic Chromium.**—In the "Comptes Rendus" of the Académie des Sciences of Paris, Guichard and his collaborators describe an investigation on the influence of the hydrogen content on the hardness of electrolytic chromium, which was heated at different temperatures. From the experiments, the authors conclude that hydrogen is not responsible for the hardness of the metal.

**Continental Pig-Iron Syndicate.**—During recent months there have been current repeated rumours concerning the stage reached by discussions for the constitution of a Continental Pig-Iron Syndicate. A statement has now been issued that no definitive plans have been discussed, and that all past negotiations have been of a purely exploratory nature. Among the many difficulties in the way of a unanimous agreement, the most complex is, perhaps, the fixing of the production quotas. Further negotiations are, however, expected to take place in the autumn.

# This Week's News in Brief.

## Trade Talk.

ALTHOUGH AUGUST was a holiday month shipments of iron and steel from the Tees were the highest since May, totalling 39,682 tons, compared with 35,555 tons in July.

THE PLANT AND MACHINERY of Swan, Hunter & Wigham Richardson's shipyard at Southwick, bought by National Shipbuilders' Security, Limited, is to be sold by auction to-day (Thursday).

MESSRS. W. & J. STEPHEN, of Macduff, have completed a motor-boat of a new type of cruiser stern for Peterhead owners. She will be propelled by crude-oil Diesel engines and fitted with all the most modern appliances.

THE FRODAIR IRON & STEEL COMPANY, LIMITED, Fenchurch House, London, E.C.3, have just been awarded a contract for six months' supply of special cylinder pig-iron, by one of the largest high-class car manufacturers.

THE SANDVIK IRON & STEEL WORKS, Sweden, have recently enlarged their works, and the foundation is now being laid of a new electro-steel plant. The firm has managed to survive the depression without reducing their staff.

MESSRS. ALBION MOTORS, LIMITED, Scotstoun, Glasgow, has received a contract for the supply of a number of six-wheel chassis from the British War Department. These six-wheelers are the type specially designed for cross-country work.

THE HOLLAND AMERICA LINER "Westerdijk" (8,261 tons) is to be broken up by Messrs. P. & W. M'Lellan, Limited, Bo'ness and Glasgow. She will be broken up in company with her sister ship, the "Eemdijk," which arrived some weeks ago.

MESSRS. JOHN LEWIS & SONS, LIMITED, Torry, Aberdeen, launched a steel screw steamer which has been specially designed for the coasting trade. The vessel, named "Deemount" by Lady Lewis, has been built for North of England owners. Messrs. Lewis have built and installed the machinery, consisting of triple-expansion engines.

AT THE SHIPYARD of Messrs. John Brown & Company, Limited, at Clydebank, where men are continually on guard to protect the £1,000,000 hull of the unfinished Cunarder from danger, an oil tank leading to furnaces became ignited. Yard firemen managed to subdue the flames before they reached the furnaces. The damage was unimportant and the hull of "534" was at no time in danger.

ALTHOUGH THE 1934 British Industries Fair does not open until February 19, the Department of Overseas Trade reports that in the "heavy industries" section at Birmingham advance bookings of space by exhibitors are so far ahead of those last year, and, indeed, in any previous year, that some 55,000 square feet of indoor area are being added immediately to meet pressing demands.

THE CARGO STEAMER "Baron Elgin" has been launched by Messrs. D. & W. Henderson & Company, Limited, from their Meadowside Yard. The "Baron Elgin," which has been built to the order of Messrs. H. Hogarth & Sons, Limited, Glasgow, is a sister ship to the "Baron Dunmore," launched a month ago, and has a gross tonnage of 3,900. The machinery supplied by the builders consists of triple-expansion engines with steam from two single-ended boilers working at 210 lb. per sq. in.

THE PEARSON & KNOWLES ENGINEERING COMPANY, LIMITED, Warrington, has secured an order for a complete basic-Bessemer steel plant, to be erected at Corby, Northamptonshire, for Messrs. Stewarts & Lloyds, Limited. This will be the first modern installation for the revival of the basic Bessemer steel-manufacturing process in this country. It will be used for making the steel required as raw material for new rolling mills and tube works now in course of construction at Corby for Stewarts & Lloyds, Limited.

AT A SELECTION CONFERENCE in Motherwell last week Mr. James Walker, political secretary of the Iron and Steel Trades Confederation, was unanimously chosen to represent the Motherwell Parliamentary Division in the Labour interest at the next election. Mr. Walker, who was for 25 years divisional officer of the Iron and Steel Trades Confederation, served for 17 years on Glasgow Town Council, and acted as magistrate for some years. After being transferred to the head office of the Confederation he became Labour M.P. for Newport, Mon, during the Labour Government of 1929-31.

THE CHELSEA SCHOOL OF METALLURGY, a branch of the Chelsea Polytechnic, has issued a pamphlet giving particulars of the courses in metallurgy and assaying during the coming session. The School of Metallurgy comprises a metallurgical lecture room, a furnace room and dry-assay laboratory, a heat-treatment and physical-testing laboratory, a microphotographic studio and dark room, a research and wet analysis laboratory, and a metal workshop. The equipment includes, in addition to facilities for general metallurgical work, heat-treatment plant, thermal-analysis apparatus, and an extensive metallographic outfit. The layout of the heat-treatment shop is especially designed for practical industrial instruction and research. In addition to providing for the academic study of metallurgy, the day and evening courses are designed to meet the requirements of industrial students. Some of the special courses are run in collaboration with local firms. Other features of the instruction available are demonstrations by interested firms; films and lectures by experts; and visits to works. Full details of these courses may be obtained from the Principal, Dr. W. A. Naish, Chelsea Polytechnic, School of Metallurgy, Manresa Road, London, S.W.3.

WITH THE ERECTION at Fordingbridge, on the outskirts of the New Forest, recently, of the last of 26,265 pylons built by the Central Electricity Board, the national grid scheme was completed. The 5½-year scheme has cost £27,000,000, and has meant employment, directly or indirectly, for 200,000 workers. Altogether there are 4,000 miles of transmission lines, 2,894 miles representing lines operating at 132,000 volts, the remainder operating at 33,000 and 66,000 volts. The majority of the 26,265 towers are from 70 ft. to 80 ft. in height and average 6,900 lb. in weight, but much taller and heavier ones have had to be used for river crossings. Altogether the 273 transforming and switching stations in the grid will have a transforming capacity of 11,000,000 horse-power. The national transmission system has been split up into nine main areas, and the tower completed on Tuesday was the last in the south-west of England scheme. Some 2,500 miles are in operation at present. Towards the end of 1934 the whole system will be working, carrying a wholesale supply of electricity to almost every corner of Great Britain. It is estimated that the grids will be loaded to the extent of 70 per cent. in 1935 and fully loaded in 1940, when the output of electricity will be 25,000,000,000 units.

ALLEGATIONS OF DUMPING by Australia were made before the Tariff Commission in Wellington when the problems of the Onekaka Iron Company (in liquidation) were placed before the Commissioners. It was said that pig-iron was admitted free into New Zealand, and that this should continue as far as the United Kingdom was concerned, but that a duty of 20 per cent. should be placed upon other Empire pig-iron—including Australian—with a duty of 30 per cent. on all foreign supplies. Before operation started at Onekaka, the cost of pig-iron was £13 a ton, and with the beginning of the New Zealand industry the price was lowered to £8 a ton. With the depreciation of Australian exchange the company was subject to competition from the Commonwealth, which amounted to dumping. If the company obtained the New Zealand market it could cater for all requirements. It was stated that the price of Australian iron at the principal ports in the Commonwealth was £5 5s. a ton, but the iron had been sold at £5 17s. 6d. in Christchurch, notwithstanding the fact that it cost 25s. a ton to ship it to New Zealand and a further 10s. 11d. to land it in Christchurch. By the time these costs were deducted it would be clear that the Australian consumer was paying a higher price than the New Zealand price, minus landed costs. The Australian iron was protected by a duty of £1 a ton, but the price was so low that the shareholders of the Onekaka Company were receiving no return.

## New Companies.

**B. & A. Engineering Company, Limited.**—Capital £1,000. Directors: A. Gouk, Bush House, London, W.C.2; R. L. Aitken.

**R. Hanson-Moore, Limited,** Lismore Road, Eastbourne.—Capital £1,000. Engineers, founders, etc. Directors: R. Hanson-Moore and F. W. Ellis.

**Allen Pumps & Engineering Company, Limited,** 345, Gray's Inn Road, London, W.C.1.—Capital £1,300. Directors: J. W. Allen and L. W. Dixon.

## Personal.

MR. D. M. MACLACHLAN has been appointed manager of the ship-repairing works of Messrs. William Beardmore & Company, Limited, at Liverpool.

SIR ROBERT HADFIELD on Monday presented Sheffield University with a cheque for £5,000, to commemorate the Iron and Steel Institute's second visit to Sheffield. Sir Robert expressed a preference that the money should be used to encourage metallurgical research.

MR. JOSEPH HEPWORTH, M.P., managing director of Hepworth & Grandage, Limited, engineers and foundrymen, of Bradford, is distributing among the unemployed of his constituency (East Bradford) the bulk of the season's produce from the large kitchen gardens attached to his residence at Wood Lawn, Apperley Bridge.

### Wills.

PIKE, GEORGE, of Birmingham, tool manufacturer ... ... ... ... ... £9,437

PARROTT, G. B., of Edgbaston, Birmingham, for many years director and secretary of Messrs. Belliss & Morcom, Limited, engineers ... ... £159,576

PEPPER, J. E., of Romsey, Southampton, formerly managing director of Messrs. Taylor Bros. & Company, Limited, of the Clarence Iron and Steel Works, Hunslet (now of Trafford Park, Manchester) ... ... ... ... £69,024

## Contracts Open.

**Slough,** September 22.—Electrically-driven centrifugal pump, for the Urban District Council. The Water Engineer, Council Offices, Slough.

**Darlington,** September 15.—Cast-iron pipes, for the Durham County Water Board. Mr. W. R. Ward, clerk to the Board, 77, Northgate, Darlington.

**Johannesburg,** October 16.—Steel bridgework, for the South African Railways and Harbours. The Department of Overseas Trade. (Reference G.Y. 12,906.)

**Old Kilpatrick,** October 6.—Electrically-operated swing bridge, for the Dumbarton County Council. Messrs. Crouch & Hogg, engineers, 17, Lynedoch Street, Glasgow, C.3. (Fee £5 5s., returnable.)

**Cairo,** October 28.—Three-phase generating set and two batteries of condensers for power factor improvement, for the Ministry of the Interior. The Department of Overseas Trade. (Reference A.Y. 11,953.)

## Company Reports.

**Ferranti, Limited.**—Dividend of 6 per cent., less tax, for the year to June 30, 1933.

**Imperial Chemical Industries, Limited.**—Interim dividend in respect of 1933 of 2½ per cent. on the issued ordinary capital.

**Renold & Coventry Chain Company, Limited.**—Gross income of £135,651; available, £46,932; brought in, £12,887; to special investment reserve, £5,000; to general reserve, £5,000; ordinary dividend of 3 per cent., £20,364; carried forward, £16,873.

## Obituary.

MR. JAMES ALEXANDER HAMILTON, founder and late managing director of the Central Engine Works, Limited, Singapore, has died at his home in Glasgow.

MR. JAMES FORSYTH, for 54 years in the employ of Messrs. Cruikshank & Company, Limited, Denny Iron Works, where he was foreman of the light-moulding department for over 30 years, has died in his 69th year.

SIR GILBERT C. VYLE, managing director of Messrs. W. & T. Avery, Limited, of Birmingham, and a leading industrialist in the Midlands, died at Birmingham recently, aged 63. He was appointed managing director of W. & T. Avery, Limited, in 1912. Sir Gilbert was chairman of the British Preparatory Committee to the Ottawa Conference and a former president of the Association of British Chambers of Commerce. He also served on various committees, including Lord Chelmsford's on the British Industries Fair.

XUM

# Raw Material Markets.

The iron and steel markets continue to show steady development. Higher prices on the Continent, the movements of the exchange, and the import duties on foreign material have given the British works a better command of the home market than they have had for years past. Continental competition in pig-iron has shrunk to very small proportions indeed, while in steel also the home works are now more than holding their own. The steelworks still find a paucity of orders for the heavy products, but they are definitely busier on the lighter materials such as bars, strip, sheets and tubes. Demand for pig-iron is not very active at the moment, mainly because many consumers are covered ahead, but a better buying movement is expected shortly. The iron and steel manufacturers still find that increased activity is due mostly to developments in the home market, but export inquiry also is improving and a gradual expansion of trade with overseas customers is looked for, although there are still many difficulties in the way of doing business abroad.

## Pig-Iron.

**MIDDLESBROUGH.**—Local consumption of Cleveland iron is showing steady expansion and there is an increased demand also from users outside the district. Current consumption is equal to, if not in excess of, the present rate of production, and an early expansion of output would not be surprising. Good sales continue to be made to the light-castings manufacturers in Scotland. Quotations are unchanged. Cleveland No. 3 G.M.B. pig-iron is at 62s. 6d. for local consumption, 64s. 6d. for delivery to North-Eastern buyers beyond the Tees-side area, 62s. 3d. for delivery to Falkirk, and 65s. 3d. for delivery to Glasgow. No. 1 grade of iron is at a premium of 2s. 6d., and both No. 4 foundry and No. 4 forge descriptions are at 1s. per ton below the price of No. 3. Lower figures are accepted for export business, but the above rates are rigidly adhered to for home trade.

With regard to East Coast hematite, more iron is going into consumption at the local works than for some time, and sales to steelmakers and other users in outside districts continue to be on a good scale. In addition to deliveries to South Wales, Sheffield and other areas, some sales have been made to the Continent. The position of the producers continues to improve. Joint action with regard to prices is still delayed, quotations remaining at the old rates of 59s. for mixed numbers and 59s. 6d. for No. 1 hematite, f.o.t. makers' works.

**LANCASHIRE.**—The demand for iron from the light-castings foundries continues to be the most satisfactory feature of the market in this area. Reports from the jobbing foundries indicate an improvement here and there, but trade in this section of the pig-iron consuming industries is still capable of considerable expansion. The order-books of some Lancashire engineering concerns represent some degree of improvement compared with conditions recently, and their pig-iron requirements are correspondingly better. One or two contracts have been booked, but, generally speaking, users have already covered their requirements over the next few months, and fresh sales are likely to be only moderate for the time being. Prices are unchanged. For delivery to users in the Manchester price zone quotations are :—Staffordshire, Derbyshire and North-East Coast brands of No. 3, 67s.; Northamptonshire No. 3, 65s. 6d.; Derbyshire forge, 62s.; Scottish foundry, 80s.; East Coast hematite, 74s.; West Coast hematite, 80s. 6d. per ton. Although the tendency of prices of heavy grades of machinery scrap is towards higher levels, there is still a large tonnage of light cast-iron scrap available at low figures.

**MIDLANDS.**—Most consumers in Birmingham and South Staffordshire have contracted for their requirements over the next few months, contracts in some cases having been made until the end of the year. Consequently little new buying can be expected, unless there is a considerable expansion in the demand for foundry products. Deliveries, however, are on a good scale, and should improve further with holidays out of the way. Prices, at 62s. 6d. for Northants No. 3 and 66s. per ton for Derbyshire, Lincolnshire and North Stafford No. 3, show no change. A small rebate is obtainable by large consumers. Cleveland makers are not now offering their iron to the Midland area at the old level of 66s., and only small lots are coming through. There is no change in the position of the hematite market, many consumers being already covered. East Coast and Welsh hematites are offered at 74s. 6d. to 77s. 6d. per ton, but West Coast is controlled, and the minimum price for this area is 84s. 6d. per ton.

**SCOTLAND.**—There is a more hopeful feeling in the pig-iron market, although, so far as Scottish iron is concerned, the demand is not yet on any considerable scale. Steel-making irons are in more demand with the increased consumption at the steelworks, but foundry irons are still quiet, the only activity being in the light-castings trade, which has a preference for Middlesbrough iron. There is no change in prices. No. 3 Scottish foundry iron is at 65s. f.o.t. furnaces, with 2s. 6d. extra for No. 1, while No. 4 forge is 65s. at Coatbridge. For export quotations are :—No. 1 foundry, 69s.; No. 3, 66s. 6d. per ton, f.a.s. Glasgow. Middlesbrough iron is obtainable at 62s. 3d., f.o.t. Falkirk, and 65s. 3d. f.o.t. Glasgow. Other English iron is available at 1s. 3d. per ton below these figures. The steelworks are being offered Scottish hematite at 66s., ordinary mixed numbers of West Coast hematite at 68s. 6d., and Scottish, English and Indian basic at 57s. 6d., delivered.

## Coke.

No change in prices of foundry coke to home consumers is to be recorded, although there is still talk of attempts to establish higher levels. As a matter of fact, several of the cokemakers are prepared to book ahead at current figures, which, for delivery in Birmingham and district, are :—Best Durham coke, 36s. to 38s., with cheaper grades down to 34s.; Welsh coke, 38s. to 45s.; Scottish coke, 39s. to 40s.

## Steel.

In the semi-finished steel department business has been on a satisfactory scale. The competition experienced by British works in the home market is insignificant, and the demand from consumers appears to be growing. In some districts prices show a tendency to increase. The demand for finished steel material has improved over the week and constructional engineers appear to be somewhat busier. Export business is confined principally to small orders, but trade with overseas markets appears to be expanding.

## Scrap.

The scrap market continues to maintain a firm tone and in the South Wales area steelworks have had to concede higher prices for steel scrap to get supplies. There is no shortage of cast-iron scrap, but prices, while showing no change, are firm. There are no fresh developments in the scrap market in the Middlesbrough area. Light cast iron is selling at about 37s., with ordinary heavy cast iron at 39s. and machinery metal at 41s. Merchants, however, are not keen sellers at these prices. In South Wales heavy cast-iron scrap is available in fair quantities, and there appears to be a regular business being done at about 45s. to 46s. Light cast also has a good market and the prices quoted are from 41s. to 42s. 6d. Good cast-iron machinery scrap in cupola sides is said to be quiet and prices range from 46s. to 47s. 6d. In the Midlands most of the ironfounders are fairly busy, and a steady trade is being done in cast-iron scrap. Prices are firm. Heavy machinery metal in handy sides is offered at 47s. 6d., good heavy metal at 45s. and clean light at 38s. 6d., all delivered works. In Scotland also the foundries are more active, and machinery cast-iron scrap in pieces not exceeding 1 cwt. is firm at 50s., with ordinary cast iron to the same specification at 46s. 6d. and light cast iron at 40s., all delivered consumers' works.

## Metals.

**Copper.**—Dull conditions have prevailed in the copper market and the tone remains easy. A fair volume of liquidation has taken place, while business with consumers remains quiet. Any advance in the United States copper market due to inflation there would soon be reflected in the London market, but at the moment conditions here are not much affected by changes in the American position. Stocks in the United States are being reduced, but against this is to be placed the knowledge that production of Empire copper is being increased. Viewed as a whole, consumption is on the up grade, but the movement is slow and has not progressed far enough to enable additional supplies to be easily absorbed.

The week's prices have been as follow :—

*Cash.*—Thursday, £35 11s. 3d. to £35 12s. 6d.; Friday, £35 8s. 9d. to £35 10s.; Monday, £35 5s. to £35 7s. 6d.; Tuesday, £35 15s. to £35 17s. 6d.; Wednesday, £35 10s. to £35 11s. 3d.

*Three Months.*—Thursday, £35 15s. to £35 17s. 6d.; Friday, £35 12s. 6d. to £35 13s. 9d.; Monday, £35 10s. to £35 12s. 6d.; Tuesday, £36 to £36 2s. 6d.; Wednesday, £35 13s. 9d. to £35 15s.

**Tin.**—This market also has been weak. Though consumption is still maintained, trade demand has slackened a little, business being reported only moderate in this country and on the Continent, and quiet in the U.S.A. Messrs. Rudolf Wolff & Company state that the weakness must be ascribed largely to lack of interest on the part of buyers rather than to any outstanding pressure to sell, buyers abstaining by reason of the uncertainties which still surround the general industrial position, especially in America, where the outcome of the President's efforts to improve matters is still awaited with interest. Pending a more definite indication as to what success will be attained, buyers are inclined to cover only their more immediate requirements. Statistically, the position is sound, and it is generally expected that the figures at the end of the month will again make a favourable showing; moreover, the technical position must have improved by reason of the liquidation which has taken place in the last few weeks.

Daily quotations :—

*Cash.*—Thursday, £216 5s. to £216 7s. 6d.; Friday, £215 2s. 6d. to £215 5s.; Monday, £214 12s. 6d. to £214 15s.; Tuesday, £217 7s. 6d. to £217 10s.; Wednesday, £216 to £216 5s.

*Three Months.*—Thursday, £216 7s. 6d. to £216 10s.; Friday, £215 2s. 6d. to £215 5s.; Monday, £214 12s. 6d. to £214 15s.; Tuesday, £217 7s. 6d. to £217 10s.; Wednesday, £216 2s. 6d. to £216 5s.

**Spelter.**—Demand has been fairly well upheld, but spelter has been no exception to the easier tendency displayed by markets generally, and the position of this market, moreover, has been further weakened by the arrival of metal early in the month surplus to requirements, which has occasioned some substantial selling and liquidation, chiefly concentrated on the September position. Messrs. Rudolf Wolff & Company state that advices from the Continent indicate little or no change in the position there: business remains quiet but steady conditions prevail, and sellers for the most part show little disposition to follow the decline. In America, the market has been slightly easier, although statistics for August are again favourable, disclosing a further decrease of 8,893 tons in the stocks. The stock now (amounting to 100,247 tons) compared with the relatively high figure at the end of April (namely 142,447 tons) shows the very substantial reduction of 42,200 tons.

Price fluctuations :—

*Ordinary.*—Thursday, £16 13s. 9d.; Friday, £16 13s. 9d.; Monday, £16 15s.; Tuesday, £16 15s.; Wednesday, £16 16s. 3d.

**Lead.**—This metal has been irregular, but on the whole easier. Consumption is fairly well maintained, but trade demand has been insufficient to sustain values, and speculative interest has been light by reason of the uncertainties with which the general industrial situation is still surrounded.

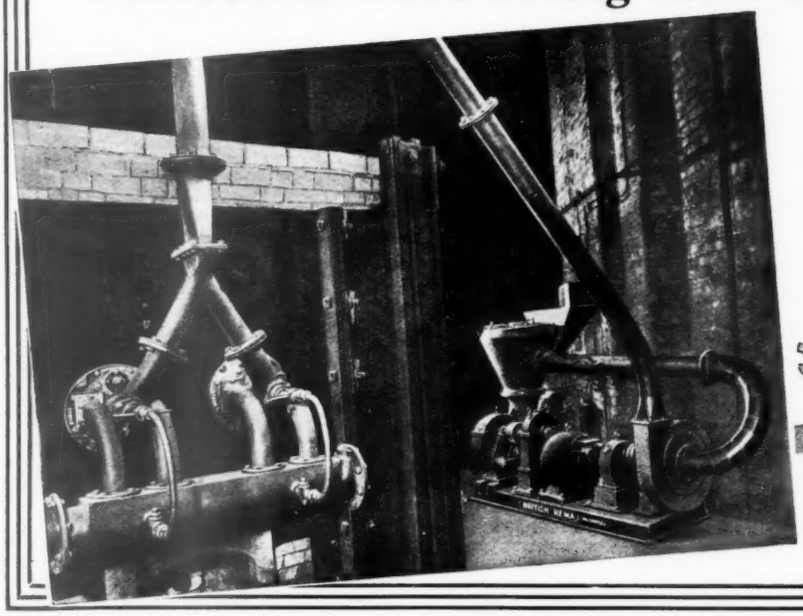
Daily market prices :—

*Soft Foreign (Prompt).*—Thursday, £12; Friday, £11 15s.; Monday, £11 15s.; Tuesday, £11 17s. 6d.; Wednesday, £11 15s.

**Rapid-Machining Steel.**—Steel, Peech & Tozer, The Ickles, Sheffield, have standardised a new rapid-machining steel under the name of "Phoenix." A booklet describing this steel states that it may be purchased in various forms and all deliveries are accompanied by a certificate of origin. "Phoenix" is the result of a two-years' research to find a superior "free-cutting steel." It has excellent physical properties and when nicked and bent yields a fine silky fracture. It is also suitable for case-hardening.

# The simplicity of the Buell System of P.F. firing is a major factor governing its low power consumption and ease of adaption to existing plant . . .

## Pulverized Fuel Firing for Metallurgical Heating.



*Every component of the Buell System has been developed to give maximum operating efficiency with reliability in service. Over 28 installations are in operation and each one confirms our two salient claims :*

MAXIMUM EFFICIENCY!
RELIABILITY!

*You are requested to investigate our System.*

The Buell Combustion Co. Ltd

49, MOORGATE, LONDON, E.C.2

*Telephone : Metropolitan 7751 (4 lines).*

Illustration shows a Buell Pulverised Fuel Plant firing a Forge Reheating Furnace.

**Works : EDGAR ALLEN & Co., Ltd., Imperial Steel Works, Sheffield.**

# WARNER C.B.R.

## CYLINDER PIG IRON

"The brand of proved reliability"

*Supplied to specifications covering a wide range of requirements and employed by the leading Railway Co's Roll Makers and Engineering Founders..*

**WARNER & CO. LIMITED**

**CARGO FLEET MIDDLESBROUGH**

# RAW MATERIALS—PRICE LIST.

**(Wednesday, September 13, 1933.)**

## COPPER.

| | £ | s. | d. |
|---|---|---|---|
| Standard cash | 35 | 10 | 0 |
| Three months | 35 | 13 | 9 |
| Electrolytic | 38 | 10 | 0 |
| Tough | 37 | 5 | 0 |
| Best selected | 38 | 0 | 0 |
| Sheets | 66 | 0 | 0 |
| India | 47 | 10 | 0 |
| Wire bars | 39 | 5 | 0 |
| Ingot bars | 39 | 5 | 0 |
| H.C. wire rods | 41 | 5 | 0 |
| Off. av. cash, August | 36 | 2 | 3 3/11 |
| Do., 3 mths., August | 36 | 6 | 6½ |
| Do., Sttlmnt., August | 36 | 2 | 4 7/11 |
| Do., Electro, August | 40 | 12 | 7 4/11 |
| Do., B.S., August | 39 | 10 | 3½ |
| Do., wire bars, August | 41 | 0 | 8 3/11 |
| Solid drawn tubes | | | 10½d. |
| Brazed tubes | | | 10½d. |
| Wire | | | 7d. |

## BRASS.

| | |
|---|---|
| Solid drawn tubes | 9½d. |
| Brazed tubes | 11½d. |
| Rods, drawn | 8¼d. |
| Rods, extd. or rlld. | 5d. |
| Sheets to 10 w.g. | 7¾d. |
| Wire | 7¾d. |
| Rolled metal | 7¾d. |
| Yellow metal rods | 4¾d. |
| Do. 4 × 4 Squares | 5¾d. |
| Do. 4 × 3 Sheets | 5¾d. |

## TIN.

| | £ | s. | d. |
|---|---|---|---|
| Standard cash | 216 | 0 | 0 |
| Three months | 216 | 2 | 6 |
| English | 216 | 10 | 0 |
| Bars | 218 | 0 | 0 |
| Straits | 222 | 15 | 0 |
| Australian (nom.) | | — | |
| Eastern | 222 | 5 | 0 |
| Banca | 222 | 0 | 0 |
| Off. av. cash, August | 215 | 5 | 10 10/11 |
| Do., 3 mths., August | 215 | 5 | 4 17/22 |
| Do., Sttlmt., August | 215 | 5 | 10 10/11 |

## SPELTER.

| | £ | s. | d. |
|---|---|---|---|
| Ordinary | 16 | 16 | 3 |
| Remelted | 16 | 10 | 0 |
| Hard | 14 | 10 | 0 |
| Electro 99.9 | 19 | 2 | 6 |
| English | 17 | 10 | 0 |
| India | 16 | 10 | 0 |
| Zinc dust | 20 | 0 | 0 |
| Zinc ashes | 4 | 0 | 0 |
| Off. aver., August | 16 | 19 | 0 3/4 |
| Aver. spot, August | 16 | 17 | 4 7/11 |

## LEAD.

| | £ | s. | d. |
|---|---|---|---|
| Soft foreign ppt. | 11 | 15 | 0 |
| Empire | 12 | 2 | 6 |
| English | 13 | 5 | 0 |
| Off. average, August | 12 | 6 | 4 3/4 |
| Average spot, August | 12 | 3 | 7 7/11 |

## ALUMINIUM.

| | |
|---|---|
| Ingots | £100 to £105 |
| Wire | 1/1 to 1/9 lb. |
| Sheet and foil | 1/2 to 2/9 lb. |

## ZINC SHEETS, &c.

| | £ | s. | d. |
|---|---|---|---|
| Zinc sheets, English | 25 | 15 | 0 |
| Do., V.M. ex-whse. | 25 | 5 | 0 |
| Rods | 30 | 10 | 0 |

## ANTIMONY.

| | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| English | 37 | 10 | 0 | to | 40 | 0 | 0 |
| Chinese, ex-whse. | | | | | 26 | 10 | 0 |
| Crude | | | | | | — | |

## QUICKSILVER.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Quicksilver | 8 | 15 | 0 | to | 9 | 2 | 0 |

## FERRO-ALLOYS AND STEEL-MAKING METALS.

| | |
|---|---|
| Ferro-silicon— | |
| 25% | 6 10 0 |
| 45/50% | 12 10 0 |
| 75% | 18 2 6 |
| Ferro-vanadium— | |
| 35/50% | 12/8 lb. Va. |
| Ferro-molybdenum— | |
| 70/75% carbon-free of Mo. | 5/6 per lb. |
| Ferro-titanium— | |
| 23/25% carbon-free | 9d. lb. |
| Ferro-phosphorus, 20/25% | £14 10 0 |
| Ferro-tungsten— | |
| 80/85% | 1/9 lb. |
| Tungsten metal powder— | |
| 98/99% | 2/- lb. |
| Ferro-chrome— | |
| 2/4% car. | 25 10 0 |
| 4/6% car. | 21 17 6 |
| 6/8% car. | 19 7 6 |
| 8/10% car. | 18 17 6 |
| Ferro-chrome— | |
| Max. 2% car. | 29 15 0 |
| Max. 1% car. | 30 17 6 |
| Max. 0.70% car. | 35 15 0 |
| 70%, carbon-free | 10d. lb. |
| Nickel—99.5/100% | £225 to £230 |
| "F" nickel shot | £202 10 0 |
| Ferro-cobalt, 98/99% | 5/6 lb. |
| Metallic chromium— | |
| 96/98% | 2/8 lb. |
| Ferro-manganese (net)— | |
| 76/80% loose | £10 15 0 to £11 5 0 |
| 76/80% packed | £11 15 0 to £12 5 0 |
| 76/80% export | (nom.) £9 15 0 |
| Metallic manganese— | |
| 94/96% carbon-free | 1/2 lb. |

Per ton unless otherwise stated.

## HIGH-SPEED TOOL STEEL.

| | |
|---|---|
| Finished bars, 14% tungsten | 2s. 0d. |
| Finished bars, 18% tungsten | 2s. 9d. |

Per lb. net, d/d buyers' works.

Extras—

| | |
|---|---|
| Rounds and squares, 3 in. and over | 4d. lb. |
| Rounds and squares, under ½ in. to ¼ in. | 3d. lb. |
| Do., under ¼ in. to 1/16 in. | 1/- lb. |
| Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in. | 3d. lb. |
| Do., under ½ in. × ¼ in. | 1/- lb. |
| Bevels of approved sizes and sections | 6d. lb. |

Bars cut to length, 10% extra.

## SCRAP.

| | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| South Wales— | | | | | | | |
| Heavy steel | | | | | 2 | 5 | 0 |
| Bundled steel and shrngs. | | | | | 2 | 2 | 0 |
| Mixed iron and steel | | | | | 2 | 4 | 0 |
| Heavy cast iron | 2 | 5 | 0 | to 2 | 6 | 0 | |
| Good machinery | 2 | 6 | 0 | to 2 | 7 | 6 | |
| Cleveland— | | | | | | | |
| Heavy steel | | | | | 2 | 3 | 6 |
| Steel turnings | | | | | 1 | 11 | 6 |
| Cast-iron borings | | | | | 1 | 2 | 0 |
| Heavy forge | | | | | 2 | 10 | 0 |
| W.I. piling scrap | | | | | 2 | 0 | 0 |
| Cast-iron scrap | 1 | 19 | 0 | to 2 | 1 | 0 | |
| Midlands— | | | | | | | |
| Light cast-iron scrap | 1 | 18 | 6 | to 2 | 0 | 0 | |
| Heavy wrought iron | | | | | 2 | 7 | 6 |
| Steel turnings, f.o.r. | | | | | 1 | 5 | 6 |
| Scotland— | | | | | | | |
| Heavy steel | | | | | 2 | 2 | 6 |
| Ordinary cast iron | | | | | 2 | 6 | 6 |
| Engineers' turnings | | | | | 1 | 12 | 6 |
| Cast-iron borings | | | | | 1 | 13 | 6 |
| Wrought-iron piling | 2 | 3 | 6 | to 2 | 5 | 0 | |
| Heavy machinery | | | | | 2 | 10 | 0 |

London—Merchants' buying prices, delivered yard.

| | £ | s. | d. |
|---|---|---|---|
| Copper (clean) | 29 | 0 | 0 |
| Brass | 19 | 10 | 0 |
| Lead (less usual draft) | 11 | 0 | 0 |
| Tea lead | 8 | 10 | 0 |
| Zinc | 10 | 10 | 0 |
| New aluminium cuttings | 72 | 0 | 0 |
| Braziery copper | 26 | 0 | 0 |
| Gunmetal | 27 | 0 | 0 |
| Hollow pewter | 135 | 0 | 0 |
| Shaped black pewter | 100 | 0 | 0 |

## PIG-IRON.

*(f.o.t. unless otherwise stated.)*

| | |
|---|---|
| N.E. Coast (d/d Tees-side area)— | |
| Foundry No. 1 | 65/- |
| Foundry No. 3 | 62/6 |
| ,, at Falkirk | 62/3 |
| ,, at Glasgow | 65/3 |
| Foundry No. 4 | 61/6 |
| Forge No. 4 | 61/6 |
| Hematite No. 1, f.o.t. | 59/6 |
| Hematite M/Nos., f.o.t. | 59/- |
| N.W. Coast— | |
| Hem. M/Nos. d/d Glas. | 68/6 |
| ,, d/d Birm. | 84/6 |
| Malleable iron d/d Birm. | 115/- |
| Midlands (d/d Birmingham dist.)— | |
| Staffs No. 4 forge | 62/- |
| ,, No. 3 fdry. | 66/- |
| Northants forge | 58/6 |
| ,, fdry. No. 3 | 62/6 |
| ,, fdry No. 1 | 65/6 |
| Derbyshire forge | 62/- |
| ,, fdry. No. 3 | 66/- |
| ,, fdry. No. 1 | 69/- |
| Scotland— | |
| Foundry No. 1 | 67/6 |
| ,, No. 3 | 65/- |
| Hem. M/Nos. d/d | 66/- |
| Sheffield (d/d district)— | |
| Derby forge | 59/6 |
| ,, fdry. No. 3 | 63/6 |
| Lincs forge | 59/6 |
| ,, fdry. No. 3 | 63/6 |
| E.C. hematite | 73/6 |
| W.C. hematite | 83/6 |
| Lancashire (d/d eq. Man.)— | |
| Derby fdry. No. 3 | 67/- |
| Staffs fdry. No. 3 | 67/- |
| Northants fdry. No. 3 | 65/6 |
| Cleveland fdry. No. 3 | 67/- |
| Dalzell, No. 3 (special) | 102/6 to 105/- |
| Glengarnock, No. 3 | 80/- |
| Clyde, No. 3 | 80/- |
| Monkland, No. 3 | 80/- |
| Summerlee, No. 3 | 80/- |
| Eglinton, No. 3 | 80/- |
| Gartsherrie, No. 3 | 80/- |
| Shotts, No. 3 | 80/- |

## FINISHED IRON AND STEEL.

*Usual district deliveries for iron; delivered consumer's station for steel.*

| | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| Iron— | | | | | | | |
| Bars (cr.) | 9 | 0 | 0 | to | 9 | 15 | 0 |
| Nut and bolt iron | 6 | 15 | 0 | to | 7 | 10 | 0 |
| Hoops | 10 | 10 | 0 | to | 12 | 0 | 0 |
| Marked bars (Staffs) f.o.t. | | | | | 12 | 0 | 0 |
| Gas strip | 10 | 10 | 0 | to | 12 | 0 | 0 |
| Bolts and nuts, ¾ in. × 4 in. | | | | | 13 | 0 | 0 |
| Steel— | | | | | | | |
| Plates, ship, etc. | 8 | 15 | 0 | to | 8 | 17 | 6 |
| Boiler plts. | | | | | 8 | 5 | 0 |
| Chequer plts. | | | | | 10 | 7 | 6 |
| Angles | | | | | 8 | 7 | 6 |
| Tees | | | | | 9 | 7 | 6 |
| Joists | | | | | 8 | 15 | 0 |
| Rounds and squares, 3 in. to 5½ in. | | | | | 9 | 7 | 6 |
| Rounds under 3 in. to ¾ in. (Untested) | | | 6 | 17 | 6 | & up. | |
| Flats—8 in. wide and over | | | | | 8 | 12 | 6 |
| ,, under 8 in. and over 5 in. | | | | | 8 | 17 | 6 |
| Rails, heavy | 8 | 5 | 0 | to | 8 | 10 | 0 |
| Fishplates | | | | | 12 | 0 | 0 |
| Hoops (Staffs) | | | 9 | 10 | 0 | & up. | |
| Black sheets, 24g. (4-t. lots) | | | | | 10 | 0 | 0 |
| Galv. cor. shts. ( ,, ) | | | | | 12 | 10 | 0 |
| Galv. flat shts. ( ,, ) | | | | | 11 | 0 | 0 |
| Galv. fencing wire, 8g. plain | | | | | 14 | 0 | 0 |
| Billets, soft | 5 | 0 | 0 | to | 5 | 12 | 6 |
| Billets, hard | 6 | 12 | 6 | to | 7 | 2 | 6 |
| Sheet bars | 4 | 15 | 0 | to | 5 | 7 | 6 |
| Tin bars | | | | | 4 | 15 | 0 |

## PHOSPHOR BRONZE.

| | Per lb. basis. |
|---|---|
| Strip | 11d. |
| Sheet to 10 w.g. | 12d. |
| Wire | 12½d. |
| Rods | 11d. |
| Tubes | 15½d. |
| Castings | 13d. |

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

## NICKEL SILVER, &c.

| | Per lb. |
|---|---|
| Ingots for raising | 7d. to 1/1 |
| Rolled— | |
| To 9 in. wide | 1/1 to 1/7 |
| To 12 in. wide | 1/1½ to 1/7½ |
| To 15 in. wide | 1/1½ to 1/7½ |
| To 18 in. wide | 1/2 to 1/8 |
| To 21 in. wide | 1/2½ to 1/8½ |
| To 25 in. wide | 1/3 to 1/9 |
| Ingots for spoons and forks | 7d. to 1/3½ |
| Ingots rolled to spoon size | 10d. to 1/6½ |
| Wire round— | |
| to 10g. | 1/4½ to 1/11½ |

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

## AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

| | Dols. |
|---|---|
| No. 2 foundry, Phila. | 18.34 |
| No. 2 foundry, Valley | 17.50 |
| No. 2 foundry, Birm. | 13.50 |
| Basic | 18.89 |
| Bessemer | 19.89 |
| Malleable | 19.39 |
| Grey forge | 19.39 |
| Ferro-mang. 80%, seaboard | 82.00 |
| O.-h. rails, h'y, at mill | 40.00 |
| Billets | 26.00 |
| Sheet bars | 26.00 |
| Wire rods | 35.00 |
| | Cents. |
| Iron bars, Phila. | 1.86 |
| Steel bars | 1.60 |
| Tank plates | 1.60 |
| Beams, etc. | 1.60 |
| Skelp, grooved steel | 1.60 |
| Steel hoops | 1.75 |
| Sheets, black, No. 24 | 2.25 |
| Sheets, galv., No. 24 | 2.85 |
| Wire nails | 2.10 |
| Plain wire | 2.10 |
| Barbed wire, galv. | 2.60 |
| Tinplates, 100-lb. box | $4.25 |

## COKE (at ovens).

| | |
|---|---|
| Welsh foundry | 20/- to 22/6 |
| ,, furnace | 15/- to 15/6 |
| Durham and Northumberland— | |
| ,, foundry | 21/- to 25/- |
| ,, furnace | 13/6 |
| Midlands, foundry | — |
| ,, furnace | — |

## TINPLATES.

f.o.b. Bristol Channel ports.

| | | | |
|---|---|---|---|
| I.C. cokes | 20×14 per box | 16/9 | to 17/3 |
| ,, | 28×20 ,, | 33/6 | to 34/6 |
| ,, | 20×10 ,, | 23/10 | to 24/4 |
| ,, | 18¾×14 ,, | 17/4½ | to 17/9 |
| C.W. | 20×14 ,, | 15/6 | to 16/- |
| ,, | 28×20 ,, | | 32/3 |
| ,, | 20×10 ,, | | 22/9 |
| ,, | 18¾×14 ,, | | 16/6 |

## SWEDISH CHARCOAL IRON & STEEL.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pig-iron | £6 | 0 | 0 | to | £7 | 0 | 0 |
| Bars-hammered, basis | £16 | 0 | 0 | to | £16 | 10 | 0 |
| Bars and nail-rods, rolled, basis | £15 | 15 | 0 | to | £16 | 0 | 0 |
| Blooms | £10 | 0 | 0 | to | £12 | 0 | 0 |
| Keg steel | £30 | 0 | 0 | to | £31 | 0 | 0 |
| Faggot steel | £18 | 0 | 0 | to | £23 | 0 | 0 |
| Bars and rods dead soft, st'l | £10 | 0 | 0 | to | £12 | 0 | 0 |

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

## DAILY FLUCTUATIONS.

### Standard Copper (cash).

| | | £ | s. | d. | | |
|---|---|---|---|---|---|---|
| Sept. | 7 .. | 35 | 11 | 3 | dec. | 3/9 |
| „ | 8 .. | 35 | 8 | 9 | „ | 2/6 |
| „ | 11 .. | 35 | 5 | 0 | „ | 3/9 |
| „ | 12 .. | 35 | 15 | 0 | inc. | 10/- |
| „ | 13 .. | 35 | 10 | 0 | dec. | 5/- |

### Electrolytic Copper.

| | | £ | s. | d. | | |
|---|---|---|---|---|---|---|
| Sept. | 7 .. | 39 | 0 | 0 | No | change |
| „ | 8 .. | 38 | 15 | 0 | dec. | 5/- |
| „ | 11 .. | 38 | 15 | 0 | No | change |
| „ | 12 .. | 39 | 0 | 0 | inc. | 5/- |
| „ | 13 .. | 38 | 10 | 0 | dec. | 10/- |

### Standard Tin (cash).

| | | £ | s. | d. | | |
|---|---|---|---|---|---|---|
| Sept. | 7 .. | 216 | 5 | 0 | dec. | 22/6 |
| „ | 8 .. | 215 | 2 | 6 | „ | 22/6 |
| „ | 11 .. | 214 | 12 | 6 | „ | 10/- |
| „ | 12 .. | 217 | 7 | 6 | inc. | 55/- |
| „ | 13 .. | 216 | 0 | 0 | dec. | 27/6 |

### Tin (English ingots).

| | | £ | s. | d. | | |
|---|---|---|---|---|---|---|
| Sept. | 7 .. | 216 | 15 | 0 | dec. | 25/- |
| „ | 8 .. | 215 | 15 | 0 | „ | 20/- |
| „ | 11 .. | 215 | 5 | 0 | „ | 10/- |
| „ | 12 .. | 218 | 0 | 0 | inc. | 55/- |
| „ | 13 .. | 216 | 10 | 0 | dec. | 30/- |

### Spelter (ordinary).

| | | £ | s. | d. | | |
|---|---|---|---|---|---|---|
| Sept. | 7 .. | 16 | 13 | 9 | dec. | 5/- |
| „ | 8 .. | 16 | 13 | 9 | No | change |
| „ | 11 .. | 16 | 15 | 0 | inc. | 1/3 |
| „ | 12 .. | 16 | 15 | 0 | No | change |
| „ | 13 .. | 16 | 16 | 3 | inc. | 1/3 |

### Spelter (Electro, 99.9 per cent.).

| | | £ | s. | d. | | |
|---|---|---|---|---|---|---|
| Sept. | 7 .. | 19 | 0 | 0 | dec. | 5/- |
| „ | 8 .. | 19 | 0 | 0 | No | change |
| „ | 11 .. | 19 | 0 | 0 | „ | „ |
| „ | 12 .. | 19 | 2 | 6 | inc. | 2/6 |
| „ | 13 .. | 19 | 2 | 6 | No | change |

### Zinc Sheets (English).

| | | £ | s. | d. | | |
|---|---|---|---|---|---|---|
| Sept. | 7 .. | 25 | 15 | 0 | No | change |
| „ | 8 .. | 25 | 15 | 0 | „ | „ |
| „ | 11 .. | 25 | 15 | 0 | „ | „ |
| „ | 12 .. | 25 | 15 | 0 | „ | „ |
| „ | 13 .. | 25 | 15 | 0 | „ | „ |

### Lead (English).

| | | £ | s. | d. | | |
|---|---|---|---|---|---|---|
| Sept. | 7 .. | 13 | 10 | 0 | No | change |
| „ | 8 .. | 13 | 5 | 0 | dec. | 5/- |
| „ | 11 .. | 13 | 5 | 0 | No | change |
| „ | 12 .. | 13 | 5 | 0 | „ | „ |
| „ | 13 .. | 13 | 5 | 0 | „ | „ |

## AVERAGE MONTHLY PRICES OF MARKED BARS (SOUTH STAFFS).

| Year | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Yearly average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| 1899 .. .. | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 10 0 | 8 10 0 | 9 0 0 | 9 0 0 | 9 10 0 | 10 0 0 | 10 0 0 | 10 0 0 | 8 3 4 |
| 1900 .. .. | 11 0 0 | 11 10 0 | 11 10 0 | 11 10 0 | 11 10 0 | 1 10 0 | 11 10 0 | 11 10 0 | 11 10 0 | 11 10 0 | 11 10 0 | 11 10 0 | 11 5 10 |
| 1901 .. .. | 9 10 0 | 9 10 0 | 9 10 0 | 9 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 16 8 |
| 1902 .. .. | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 5 0 | 8 5 0 | 8 5 0 | 8 5 0 | 8 5 0 | 8 5 0 | 8 7 6 |
| 1903 .. .. | 8 5 0 | 8 5 0 | 8 5 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 8 9 |
| 1904 .. .. | 8 10 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 10 |
| 1905 .. .. | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 10 0 | 8 10 0 | 8 1 8 |
| 1906 .. .. | 8 10 0 | 9 0 0 | 9 0 0 | 9 0 0 | 9 0 0 | 9 0 0 | 9 0 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 9 0 0 | 8 15 10 |
| 1907 .. .. | 9 0 0 | 9 0 0 | 9 0 0 | 9 0 0 | 9 0 0 | 9 0 0 | 9 0 0 | 9 0 0 | 9 0 0 | 9 0 0 | 9 0 0 | 9 0 0 | 9 0 0 |
| 1908 .. .. | 9 0 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 5 10 |
| 1909 .. .. | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 |
| 1910 .. .. | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 9 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 |
| 1911 .. .. | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 0 0 |
| 1912 .. .. | 8 10 0 | 8 10 0 | 8 10 0 | 8 15 0 | 9 0 0 | 9 0 0 | 9 0 0 | 9 8 0 | 9 10 0 | 9 10 0 | 9 10 0 | 9 15 0 | 9 1 6 |
| 1913 .. .. | 10 0 0 | 10 0 0 | 10 0 0 | 10 0 0 | 10 0 0 | 10 0 0 | 10 0 0 | 9 10 0 | 9 10 0 | 9 4 0 | 9 0 0 | 9 0 0 | 9 12 8 |
| 1914 .. .. | 8 12 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 8 10 0 | 9 0 0 | 9 0 0 | 9 0 0 | 9 0 0 | 9 0 0 | 8 14 4 |
| 1915 .. .. | 9 0 0 | 9 0 0 | 9 3 0 | 10 2 0 | 10 15 0 | 11 10 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 7 6 | 12 10 0 | 13 10 0 | 11 5 0 |
| 1916 .. .. | 13 10 0 | 13 10 0 | 14 13 0 | 15 0 0 | 15 0 0 | 15 0 0 | 15 0 0 | 15 10 0 | 15 10 0 | 15 0 0 | 15 10 0 | 15 0 0 | 14 18 7 |
| 1917 .. .. | 15 10 0 | 15 10 0 | 15 10 0 | 15 10 0 | 15 10 0 | 15 10 0 | 15 10 0 | 15 10 0 | 15 10 0 | 15 10 0 | 15 10 0 | 15 10 0 | 15 10 6 |
| 1918 .. .. | 15 12 6 | 16 0 0 | 16 0 0 | 16 0 0 | 16 0 0 | 16 0 0 | 16 0 0 | 16 0 0 | 16 0 0 | 17 0 0 | 17 0 0 | 17 0 0 | 16 6 3 |
| 1919 .. .. | 18 0 0 | 18 10 0 | 20 0 0 | 20 0 0 | 23 0 0 | 23 0 0 | 23 0 0 | 24 12 0 | 25 0 0 | 25 0 0 | 25 0 0 | 25 5 0 | 22 10 7 |
| 1920 .. .. | 26 17 6 | 27 0 0 | 28 0 0 | 30 5 0 | 30 10 0 | 33 10 0 | 33 10 0 | 33 10 0 | 33 10 0 | 33 10 0 | 33 10 0 | 33 10 0 | 31 10 2 |
| 1921 .. .. | 31 10 0 | 30 3 4 | 27 10 0 | 27 10 0 | 27 10 0 | 24 15 0 | 21 0 0 | 20 0 0 | 20 0 0 | 17 10 0 | 17 0 0 | 16 0 0 | 23 7 4 |
| 1922 .. .. | 16 0 0 | 14 17 6 | 14 10 0 | 13 10 0 | 13 10 0 | 13 10 0 | 13 10 0 | 13 10 0 | 13 10 0 | 13 10 0 | 13 10 0 | 13 10 0 | 13 18 1½ |
| 1923 .. .. | 13 10 0 | 13 10 0 | 13 16 0 | 14 7 6 | 14 10 0 | 14 10 0 | 14 10 0 | 14 10 0 | 14 10 0 | 14 10 0 | 14 10 0 | 14 10 0 | 14 5 3½ |
| 1924 .. .. | 14 10 0 | 14 10 0 | 14 10 0 | 15 0 0 | 15 0 0 | 15 0 0 | 15 0 0 | 15 0 0 | 15 0 0 | 15 0 0 | 15 0 0 | 14 17 6 | 14 17 3½ |
| 1925 .. .. | 15 0 0 | 15 0 0 | 15 0 0 | 15 0 0 | 15 0 0 | 14 10 0 | 14 10 0 | 14 10 0 | 14 10 0 | 14 10 0 | 14 10 0 | 14 0 0 | 14 13 4 |
| 1926 .. .. | 14 0 0 | 14 0 0 | 14 0 0 | 14 0 0 | 14 0 0 | 14 0 0 | 14 0 0 | 14 0 0 | 14 0 0 | 14 0 0 | * | 14 10 0 | 14 0 10 |
| 1927 .. .. | 14 10 0 | 14 10 0 | 14 10 0 | 14 10 0 | 14 10 0 | 13 10 0 | 13 10 0 | 13 10 0 | 13 10 0 | 13 0 0 | 13 0 0 | 12 18 0 | 13 15 8 |
| 1928 .. .. | 12 10 0 | 12 10 0 | 12 10 0 | 12 2 6 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 2 8½ |
| 1929 .. .. | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 7 6 | 12 10 0 | 12 10 0 | 12 2 3½ |
| 1930 .. .. | 12 10 0 | 12 10 0 | 12 10 0 | 12 10 0 | 12 10 0 | 12 10 0 | 12 10 0 | 12 10 0 | 12 10 0 | 12 10 0 | 12 10 0 | 12 10 0 | 12 10 9 |
| 1931 .. .. | 12 10 0 | 12 10 0 | 12 10 0 | 12 8 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 3 2 |
| 1932 .. .. | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 |
| 1933 .. .. | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | 12 0 0 | — | — | — | — | — |

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